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Incorporating CANNING PACKING & PRESERVING

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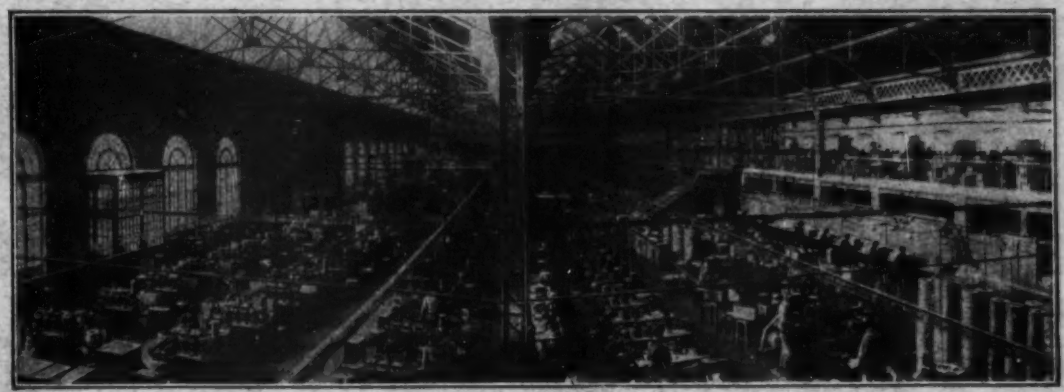

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STAND No. E.86

Welcome

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FOOD Manufacture

Incorporating Canning, Packing, and Preserving

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The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

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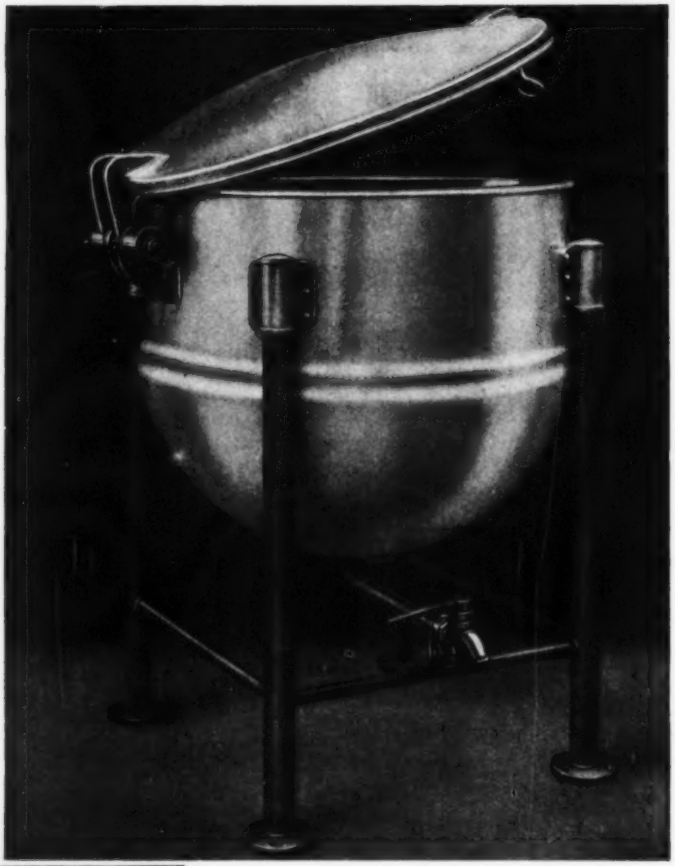

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Food Manufacture
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Vol. IX. **February, 1934** **No. 2**

Lead in Sardines

THE PAPER of Lampitt and Rooke which was read before the Society of Public Analysts in October last has now been published in the December organ of that Society, and it should be studied by those who deal in sardines. It was found that lead occurs frequently in canned sardines and often to a serious amount. In one case as much as 150 parts per million of lead were found. It is frequently assumed that the oil surrounding the fish is sufficient to prevent metallic contamination, but the work now being discussed proves the contrary, and it is almost certain that lead is picked up from the solder in the tins or from the cooking grills. It was discovered that French packed sardines had a lower content of lead than Portuguese, presumably owing to the fact that in France the solder used in food containers must not contain more than 2 per cent. of lead, whereas the solder in Portuguese cans has been found to contain as much as 80 per cent. of lead.

Sources of Lead

The authors investigated the three possible sources of lead in sardines: (*a*) Present naturally in the fish, (*b*) introduced by method of preparation, and (*c*) introduced by method of packing. Samples of raw sardines sent in lead-free glass bottles contained no lead. It was also discovered that there was no regular relationship between the amount of exposed solder in the cans and the amount of lead found in the sardines. One sample of sardines with no exposed solder in the can had 40 parts per million of lead; whereas one with a large amount of solder exposed had only 10 parts per million. An important conclusion was that the presence of lead in the metal used for tinning the grills causes serious contamination of the sardines during the cooking process. The liability to contamination, if impure tin is used, is much greater in the method where steam is used than in the frying method, and this is borne out by the higher lead content of sardines prepared according to the Portuguese method.

Determination of Lead

The determination of the lead content in these samples is of interest. Two methods were employed, a chemical method and a photospectrometric method. The determination of small amounts of lead is a matter of no little difficulty, and we have heard of very widely differing results obtained on the same sample by different analysts. The two methods described in this paper will doubtless be of interest to analysts who have from time to time to determine the amount of lead in different foodstuffs.

Sugar Beet Folly

Nine years ago the sugar beet development was set up and was intended to be a nine years' experiment. Having proved a costly failure it should now be dropped. Those nine years have cost the Exchequer £40,000,000, and the net result is the discovery that beet sugar production in Britain can only on a very limited scale, if at all, be an economical employment for farming energy and as a source of supply. In a recent issue of *The Times*, Lord Olivier has made a reasoned and balanced

statement in which he has marshalled the facts for and against the production of sugar beet in this country. As he pointed out, the fundamental facts are quite simple. When the policy was first discussed between the Development Commissioners and the Board of Agriculture it appeared justifiably promising. But they calculated on the basis of a yield of not less than 12½ to 13 tons of beetroot for every acre sown. The Ministry of Agriculture, the British Sugar Beet Society, and other people have made every effort to achieve this estimate, but the best ever reached in the most favourable season was only 8·7 tons per acre, and this year it will not exceed 7·5 tons.

Comparisons with Cane Sugar

To grasp the real facts of the situation the British production should be compared with the large West Indian factories. The yield of cane per acre averages 25 tons and its sugar content is 12 per cent. The sugar content of beet is about 15½ per cent. The price offered to British farmers for the next crop is 37s. 6d. per ton on a content of 15½ per cent. of sucrose. That is, £12 1s. 11d. a ton of sucrose. A West Indian factory (which made 46,097 tons of sugar last year) paid its farmers 14s. a ton for cane with an average sucrose content of 12 per cent.—that is, £5 16s. 8d. a ton. Hence beet sugar is costing £6 5s. 3d. a ton more than cane sugar. Thus the subsidy of £6 10s. a ton for British beet sugar, plus the extra cost of transport of cane sugar to market, puts the two sources of supply about on a level in competition, *but* at the cost of the British taxpayer. Beet sugar producers also obtain a drawback of Excise duty on raw sugar equivalent to the rebate of Customs duty allowed on Colonial imports—again at the expense of the British taxpayer.

Bad Management

As Lord Olivier pointed out, the methods employed in the sugar beet industry are absurdly impractical. Beet grown in Selsey in Sussex is carried to Selby in Yorkshire for manufacture. Selsey has a fine soil for beet growing, but so it has for other crops whose producers get no money to squander in carrying bulky and heavy crops hundreds of miles round the country. Even if farmers could produce beet at an economic yield, and this is very unlikely (8½ tons an acre certainly will not do), the questions of manipulation, handling, and transport would have to be carefully investigated and the whole business brought thoroughly up to date. The Government should be rational. The subsidy was granted to finance an experiment and not as a perpetual dole to farmers. The experiment has failed and the Government has no right at all to convert what was originally meant as an experimental cost into a continued dole. The continuation of the beet policy is a heavy drag on the food industries, not only on account of the subsidy but as to price. The Colonies can easily supply sugar and pay their way at a halfpenny a pound less than the average cost of British beet sugar production. This would be a great help to many food manufacturers.

Lord Olivier's Plan

Lord Olivier—who should be in a position to speak with authority, having been chairman of the West Indian Sugar Commission in 1930—proposes that a national board should buy at one fixed and remunerative price all sugar produced at home, at another fixed and remunerative price all sugar produced in the Empire, and the balance of requirements from foreign sources at the open market price. The board should sell sugar at the average of these three prices. Undoubtedly some such plan will have to be adopted, as the sugar industry is in a precarious position. The Chadbourne plan (for improving prices by restricting overproduction) is failing to produce the desired effect, and world production still greatly exceeds world consumption. The Cuban natives are in revolt against the plan, and it certainly cannot be counted upon. In any case, it has not prevented prices from falling. The Colonial producers are getting apprehensive. If the Chadbourne plan fails without any policy having been adopted to support the market, the Colonial producers will be faced with the very situation from which the present Government has been shielding them. Something must be done and done quickly; the Government have no business shilly-shallying with subsidies out of the taxpayer's pockets merely to make the taxpayer pay more for his sugar. The Empire resources should be exploited to the full and the Colonists encouraged to expand their cane plantations rather than be kept in a slough of despondency, doubt, and uncertainty.

Spraying of Fruit Trees

Many growers of apples and pears lose good markets because of disfigurements which mar the appearance of the fruit. The only way to avoid this is to embark on a systematic spray programme to keep the various pests in check. It should be started early in January and maintained throughout the season. For apples and pears the campaign should include spraying the trees with tar oil in January or February. This cleanses the branches of mosses and lichens and kills the eggs of the aphis, apple sucker, and other insects. There are many varieties of tar oil on the market. They can be purchased by the pint or the barrel. In April a Bordeaux mixture spray or a lime sulphur wash should be given; and lead arsenate

in May. The East Malling Research Station, Kent, has drawn up a spray calendar for 1934. It refers to the pests and diseases which attack each fruit crop and gives details of the sprays to use and when they should be applied. This should prove very useful to growers of fruit.

S. 1944

On December 8 was held the first public hearing on the so-called S.1944, or "Tugwell" Bill—the new Foods and Drugs Act which it is proposed to introduce into American legislation. Judged by the amount of adverse criticism offered at this meeting it seems fairly safe to assume that the final version of S.1944 will differ markedly from the original form in which it was drawn up.

The proceedings were opened by W. H. Campbell, chief of the Food and Drug Administration, who expounded the weaknesses of the present law and the need for a new one which would enable the Administration to do the work which lately it has been criticised for not doing

Some Objections

While the majority of those representing the consumers endorsed the Bill, one complaint was that although the new law appeared to offer protection from fraud, deceptions, and hazards to health, yet it is doubtful if it could be enforced—in much the same way that the prohibition laws were ineffective in practice.

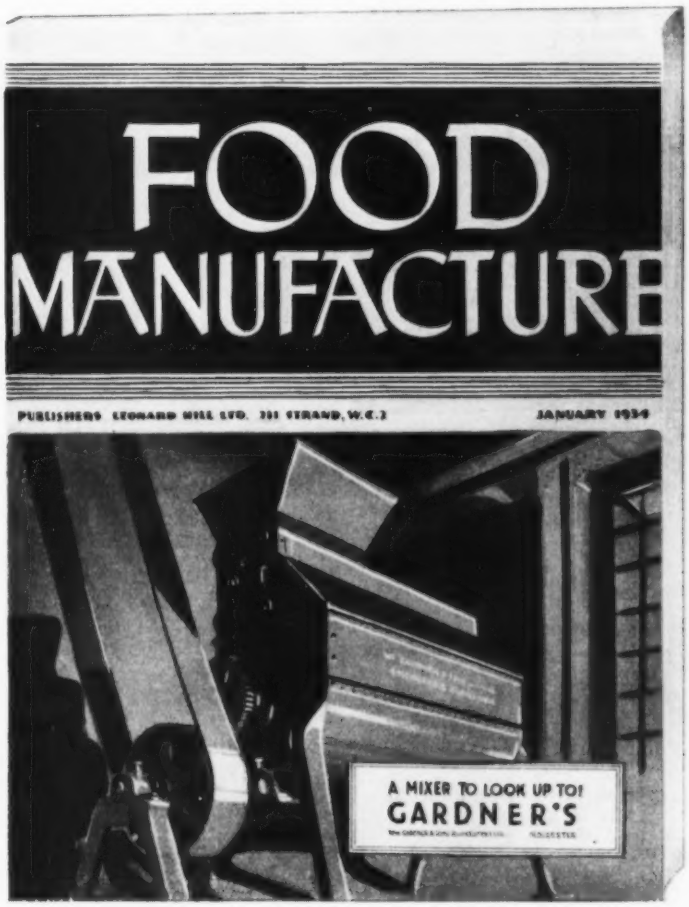
Foods, not Drugs

Sebastian Mueller, vice-president of production of H. J. Heinz Co., believed that his company could easily comply with the provisions of the Bill, but considered that there should be a separate law for regulating the food industries.

This point is being taken up by sections of the technical press, urging the food industries to demand that the proposed revisions of the food and drug law should separate entirely the food regulations from those affecting other groups of commodities.

Dr. Beal showed that spectacles, horse collars, and dog muzzles, as well as the definition of what is medicine, would come under the jurisdiction of the Secretary of Agriculture.

This is interesting because it represents the view we have previously expressed in these columns, namely, that food laws should be entirely divorced from those regulating drugs and cosmetics. These groupings are sufficiently big and important to stand on their own feet and they have nothing in common. In fact, the coupling of drugs with foods has a detrimental influence, especially in the public mind, on the latter.



The illustration reproduced above shows the new cover which has been designed for *Food Manufacture*.

Commencing with the March issue, the journal will be enlarged and its appearance improved, in order to bring it fully into line with its associated publications, *The Manufacturing Chemist* and *Paint Manufacture*.

Colours

Sebastian Mueller also asked that Section 3 (b) be modified to prohibit all synthetic colours, except perhaps for colourless foods such as ice cream and confectionery, where the consumer expects colour to be added.

Inspection

It is also interesting to note that he suggested that inspection of methods and processes should not be required, except in those cases where it is necessary for protection of public health.

Dr. Stoud Jordan objected to the dis-

closure of secret processes to inspectors, who might unintentionally pass them on to competitors by word of mouth.

Proof of Guilt

Another interesting point was made by the Associated Grocery Manufacturers of America. They stated that the British, Canadian, and present U.S. food laws all require that the burden of proof of guilt of violation be on the Government, but S.1944 reverses that policy, so that a manufacturer who has been brought into court shoulders the burden of proving that he has not violated the Secretary's opinion. This is contrary to Supreme Court decisions and is inconsistent with common law.

Chocolate Syrup

What is described as a new type of non-settling chocolate malt syrup has been developed in U.S.A. It is said to be made from chocolate by converting the starch into soluble maltose. Formerly it was necessary to heat milk containing cocoa to boiling point and then cool the chocolate milk liquid in the bottles during agitation. With the new syrup, simply stirring the chocolate and milk together is sufficient, even when the milk is cold.

Fat Bloom

We have just received a book which will prove of very great interest to chocolate makers and especially to those in this country who are familiar with the contributions of Robert Whymper to the English sections of the industry before he migrated across the Atlantic. This book is entitled *The Problem of Chocolate Fat-Bloom*, and its author is none other than Robert Whymper himself. It is a pity, in a way, that so important a work could not have been published here, especially as Whymper's earlier researches into the subject were carried out in this country.

It is not our intention to review the book at this point; that will come later. Sufficient to remark that everyone concerned with chocolate making must, in his own interests, obtain for himself a copy, and there is no doubt but that the industry as a whole will be benefited accordingly.

Vinegar from Sugar

Sugars of the glucose group are potential raw material for vinegar production, since they can be fermented with yeast and the resulting alcohol converted to vinegar in presence of acetic bacteria. Interest will certainly be aroused by the remarkable discovery that yeast can be dispensed with. It appears that under certain conditions the acetic bacteria alone are capable of promoting the reaction: glucose→alcohol→vinegar. Success depends upon exclusion of oxygen during the first stage so as to avoid formation of 6-carbon acids—*e.g.*, gluconic acid.

From the recently published German patent specification which enunciates this discovery we gather that digestion of the sugar solution-acetic ferment mash at a temperature of about 30° C. in a carbon dioxide or nitrogen atmosphere leads to ethyl alcohol formation from no less than 20 to 40 per cent. of the sugar. Following this novel anaerobic treatment, quantitative oxidation of the alcohol into vinegar is effected in the customary manner. About 15 to 20 hours are occupied by the initial anaerobic process, and a 40 to 50 per cent. yield of vinegar (calculated on the sugar) is possible if alcohol is periodically distilled off and fresh acetic ferment brought into contact with still unfermented sugar.

Formaldehyde

At the Gloucester laboratory, F. P. Griffiths has found that formaldehyde contained in the smoke has a very slight preservative effect upon light smoked finnan haddie on account of its low concentration. While brining the fish before smoking adds to the flavour, its preservative effect is practically negligible; in fact, it may in some cases become a source of infection.

Bureau of Fisheries

The U.S. Bureau of Fisheries (Dept. of Commerce) issues each year a report which constitutes a review of the fishery statistics of the United States. The Bureau of Fisheries is concerned with the activities and welfare of the fishing industries, including the fish canning and preserving. It collects statistics, conducts market surveys, and carries out researches into technical problems.

Salmon Liver Oil

The last annual report of the Bureau summarises the technical work carried out in 1932, and it includes some interesting references to the vitamin A content of salmon liver oil and the importance of oysters as a source of iron for sufferers from anæmia. The fact that halibut liver oil is potent in vitamin A has induced enquiries as to whether there might not be other fish liver oils equally, if not even more, potent. Attention was turned to salmon livers, as these are available in large quantities. Although the actual content of the oil in vitamin A is not stated in the report, the results appear to have been encouraging.

Copper, iron, and manganese have been shown to be present in oysters, hence their value in cases of anæmia.

MACARONI Manufacture

The following information is taken from an exhaustive article on Macaroni, Spaghetti, and Vermicelli, written by J. A. Le Clerc, of the Food Research Division, Bureau of Chemistry and Soils, U.S Dept. of Agriculture, and published in "Cereal Chemistry," of September, 1933.

Macaroni

MACARONI PRODUCTS, including macaroni, spaghetti, and vermicelli, have been popular in Latin and Germanic Europe for centuries. This food is said to have originated in China and Japan. The Italians, who were using macaroni in the fourteenth century, learned from the Germans how to make it. In time they became its largest producers and consumers. From Italy it found its way to France, where it was used as a food even before the time of Louis XIII.

It was at first made by hand and was sold only in apothecaries' shops, being recommended chiefly for infants and invalids. The first mechanical process was introduced about 1800. In U.S.A. the industry started about 80 years ago; during the past 20 years its growth has been phenomenal.

Definitions

Macaroni products have, in the English-speaking world, until recently been termed "alimentary pastes," a literal translation of the Italian "pasta alimentari" and/or of the French "pâtes alimentaires." The modern designation "macaroni products" is better.

According to the definitions and standards adopted by the U.S. Department of Agriculture, "Macaroni is the shaped and dried doughs prepared by adding water to one or more of the following: semolina, farina, wheat flour. It may contain added salt. In the finished product the moisture content does not exceed 13 per cent. Various shapes of macaroni are known under distinguishing names, such as spaghetti, vermicelli."

Semolina macaroni and farina macaroni are macaronis in the preparation of which semolina and farina are respectively the sole farinaceous ingredients.

Raw Materials

Macaroni products, particularly those in Europe, are made primarily from semolina obtained by milling durum wheat. This wheat is grown extensively in Russia and Algeria as well as in the U.S., and to a less extent in Canada, Chile, Syria, Spain, Italy, India, Rumania, and Argentina.

As its name implies, durum wheat is a hard wheat. It is much harder than the so-called hard wheats—*i.e.*, the hard red spring and hard red winter wheats. When grown under proper conditions of climate and moisture the grain of durum wheat is flinty throughout and semi-translucent. Because of its flinty characteristics durum is better than any other wheat for the manufacture of semolina.

There are several subclasses and grades of durum wheat. Amber durum is most suitable for the production of semolina, as it combines strength with a most desirable creamy yellow colour. Red durum should not be, and generally is not, used for making semolina, as macaroni made from it has a dull grey colour.

Semolina and Farina

Semolina and farina are defined by the National Macaroni Manufacturers' Association as follows:

"Semolina is the purified middlings obtained from the grinding of durum wheat. It is free from bran and other offal and shall contain not more than 13·5 per cent. moisture and not more than 1 per cent. of flour."

"Farina is the purified middlings obtained from the grinding of hard wheats other than durum wheats. It is free from bran and other offal and shall contain not more than 13·5 per cent. moisture and not more than 1 per cent. of flour."

Semolina is the Italian name for grits or middlings. In France the minimum of durum wheat (grown in Algeria, Tunisia, or Morocco) entering the manufacture of semolina was recently fixed at 70 per cent. In other words, not more than 30 per cent. of common wheat may be blended with the durum.

Semolina is divided into grades. The best grade consists of grits of essentially the same size, has a creamy yellow colour, and is practically free from flour and bran. As macaroni products tend to break at the point where a bran particle is found, it is essential that semolina and farina be as free from bran as possible. Long-cut macaroni should be made from the best grade of semolina. To make soup pastes, such as alphabets, stars, and other fancy short-cut patterns, the use of the best grade of semolina is not so essential.

Types

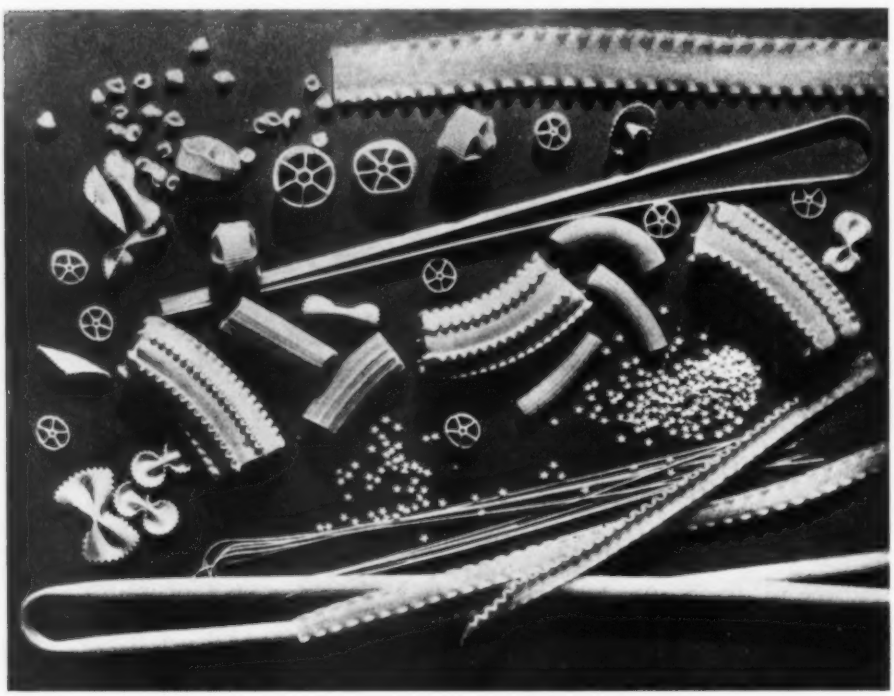
There are hundreds of kinds of macaroni products, each one differing from the other in either size or shape. The smooth, tubular forms, generally known as macaroni, are the more common. There are a number of different sizes. For example, ***Mezzani*** is one-fourth inch in diameter, and is by many regarded as the standard. ***Zitoni*** is one-half inch in diameter. ***Mezzanelli*** is five thirty-seconds inch in diameter. ***Forati*** is one-eighth inch; ***Foratini*** or ***Maccaroncelli*** is three thirty-seconds of an inch in diameter.

There are also corrugated tubular products; for example, ***Mezzani Rigati,*** one-fourth inch in diameter, and ***Zitoni Rigati,*** one-half inch in diameter.

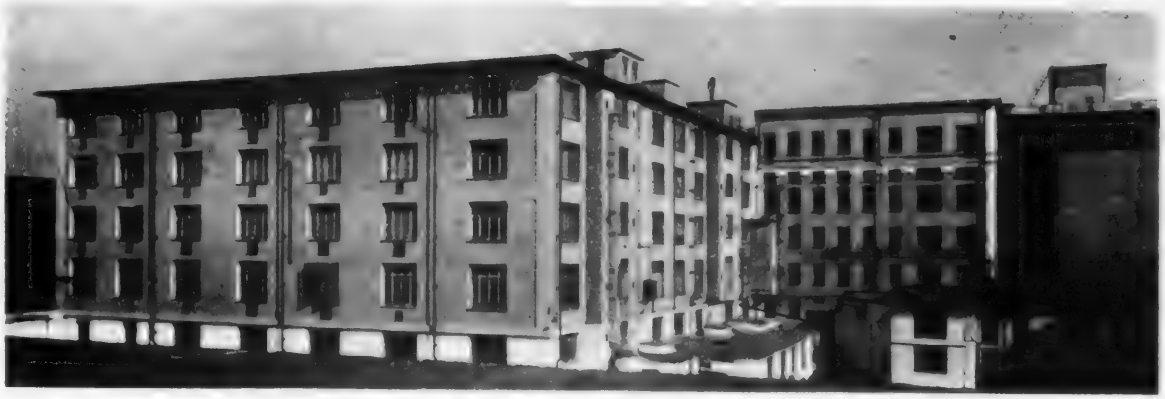
The solid-rod forms include ***Vermicelli,*** one thirty-second inch in diameter, and ***Spaghetti,*** three thirty-seconds inch in diameter.

Of the flat ribbons, ***Tagliarini*** is one-eighth inch thick, ***Linguine*** three thirty-seconds inch, and ***Fettucelli*** five-sixteenths inch thick.

Short-cut macaroni comprises the smooth tubular elbows, some small such as ***Tubetti,*** which is one-eighth inch and five thirty-seconds inch in diameter, and others large, such as ***Ditali,*** which is one-fourth inch and seven-sixteenths inch in diameter; and very large corrugated



This Illustration Shows an Interesting Selection of Different Macaroni Products.



The Agnesi Macaroni Factory at Oneglia, on the Ligurian Coast, Italy.

elbows like *Rigatoni*, which is nine-sixteenths inch in diameter.

Other forms are bunched or coiled vermicelli, alphabets, seeds, stars, and crosses.

The Italian names, generally used heretofore, are descriptive of the products.

The various types just described are illustrated here.

At present the tendency of the American manufacturer is to use English descriptive names and to eliminate as many as possible of the numerous types and sizes. Trade information indicates that fully 85 per cent. of the total output of macaroni products is composed of no more than a dozen types.

MANUFACTURE

Materials

In the United States macaroni is made, as a rule, from the best grade of semolina or farina. Some of the best macaroni products are made entirely from farina, though many of the macaroni manufacturers look upon semolina as the raw material *par excellence* for the production of the highest-grade macaroni, spaghetti, and vermicelli.

Many macaroni manufacturers at a distance from the semolina milling centres are obliged to use considerable flour, as the freight rate of semolina makes its use prohibitive. Some Pacific Coast manufacturers, for example, use flour of different grades, either as such or blended with semolina; others use farina or semolina without any admixture of flour.

Some manufacturers use a 95 per cent. hard winter flour instead of semolina.

In general, 100 lb. of flour will make 94 lb. of marketable macaroni products; from 1 to 2 per cent. of the macaroni is wasted in the process of manufacture. There is also a loss of about 4 per cent., which is largely due to the difference in moisture content of macaroni and the raw material.

Doughing

The first step in the manufacture of macaroni is the doughing process. For every 100 lb. of semolina or farina some 26 to 30 lb. of water ranging in temperature from 70° to 140° F. are used. The quantity of water varies with the kind of product to be made and the nature of the raw material, less water being used for vermicelli than for macaroni. No other ingredients (except occasionally a small percentage of salt) are used. After being mixed for 10 to 20 minutes at a temperature of about 40° C. (104° F.) the smooth, firm dough is transferred to a kneading machine or "gramola."

Kneading

The modern kneading machine consists of a revolving circular steel pan 8 feet in diameter, carrying two revolving, corrugated, conical iron workers, weighing as much as 3½ tons. In operation it is similar to a butter worker.

The dough is kneaded for 10 to 20 minutes thoroughly to incorporate the water with the semolina or farina and to produce a uniform, smooth, stiff dough.

Moulding

When thoroughly kneaded the dough may be either transferred direct to the press or rolled into sheets, folded into cylinder or cartridge form, and then transferred to the press, which is maintained at a temperature of about 104° F. to keep the dough plastic.

Presses are either vertical or horizontal. In the vertical press at the bottom of the cylinder is placed a horizontal die or perforated plate, called "trafila." The holes in the die for making macaroni vary in size according to the type to be made. Each hole has a small steel rod or pin in the centre, which forms the hole in the macaroni. While the dough is divided by the supports of the pin as it enters the die, the tremendous pressure, from 2,500 to 5,000 lb. per square inch, reunites it, and it emerges from the other end of the perforated plate as a perfect tube. The die used in making spaghetti, or solid rodlike macaroni products, has smaller holes without pins.

In general, long-cut macaroni is made in vertical presses, the macaroni being cut by hand into 3-foot lengths and bent over wooden rods for drying (see illustration).

Horizontal presses are more often used in the manufacture of elbows and other short-cut macaroni products. A

Drying Macaroni in an Italian Factory.

revolving knife cuts the macaroni at the outer face of the die, the speed of the knives determining the length of the product.

When making products in the shape of animals, alphabets, seeds, stars, etc., dies having these forms are used. The dough is rolled thin and then the figures are stamped out just as is done in the manufacture of crackers.

Drying

The drying of macaroni requires the most expert skill and judgment. It is the most important, the most difficult, and the most delicate operation in the whole process of the manufacture of macaroni products, and upon it largely depends the quality of the finished product.

In Italy macaroni is often dried in the sunshine in the open air, especially when the product is made in the small plants. Generally, a preliminary drying of about 2 hours' duration is necessary to prevent souring and to keep the short-cut products from sticking together. Very soon the paste emerges from the die or "trafila," and while still warm there is formed a crust upon the surface. This superficial drying or hardening is arrested and eliminated by placing the product in a closed humid cabinet or room. As a result of this treatment the moisture content tends to become equalised throughout, and the macaroni becomes flexible again—*i.e.*, it "comes back." The process of "hardening" or "drying" and of "coming back" or "becoming flexible" is carried on alternately. The paste is then removed from the damp room and allowed to dry completely in the open air under Italy's sunny skies. After the macaroni is thoroughly dried in the open air it is transferred to a closed but well-ventilated room where it is allowed to "rest" for several hours, after which it is again placed in the open air for 5 or 6 hours and once more allowed to "rest." It is then ready to be packed. Open-air drying requires, therefore, considerable supervision. It is generally believed that during the first day a sort of fermentation takes place which produces the much desired flavour.

When the weather does not allow the macaroni to be dried in the open, the alternate "hardening" and "softening" is conducted in specially constructed ventilated cabinets in which the drying is completed. The alternate "drying" and "resting" is for the purpose of preventing warping, as the outer part of the macaroni dries faster than does the inner portion.

Although out-of-doors drying is now considered unhygienic and obsolete, as it exposes the product to all kinds of germ-laden dust, it should be remembered that no macaroni is eaten raw. It is generally boiled for at least 10 minutes. Sound macaroni products that have been boiled can no doubt be considered safe in this respect.

In the U.S.A. and in the modern plants of European countries, practically all macaroni products are dried in specially constructed drying rooms through which a current of filtered air is blown by means of fans. The air laden with moisture from the macaroni is thus being continually replaced by clean, dry air. The temperature of the drying room ranges from 70° to 100° F. The rate of drying depends not so much on the high temperature as it does on air intake or circulation. In other words, the proper drying of macaroni depends upon correct ventilation, the temperature and hygroscopicity of the

air being taken into consideration. During the drying, the macaroni should not be exposed to sudden changes in temperature, as this may also cause the product to warp.

A preliminary drying of about 2 hours' duration is considered necessary to prevent the development of mould. The macaroni is then placed in a damp chamber in order to make uniform the moisture content throughout the product and to develop the flavour characteristic of good macaroni. After this preliminary treatment the macaroni is transferred to the drying chambers.

The long-cut macaroni is hung on sticks or canes and placed in the drying chambers. Sometimes the canes laden with macaroni are hung on a truck, which is then wheeled into the drying chamber.

Short-cut macaroni products are spread out evenly on trays. These are sometimes placed on trucks, which are wheeled into the drying chamber, or a combination of trays may form part of a drying room.

The drying proper takes from 36 to 90 hours, depending upon the efficiency of the process and the nature of the product. It is not advisable to dry macaroni too quickly, as too rapid curing fails to develop the desired flavour and gives a product which, because of the uneven distribution of moisture throughout the mass, may crack or check or split. A well-cured macaroni should bend somewhat like a whip. It is this elastic property which causes the macaroni to retain its form after being cooked.

Preparation for Marketing

When thoroughly dry the long-cut macaroni is either packed in 18-inch strips and sold in bulk or it is sawed into shorter lengths for the package trade.

The trimmings or short pieces obtained in the process of sawing macaroni into the desired lengths, and all broken, cracked, or imperfect macaroni are sold together in bulk as broken macaroni at a much reduced price. This is just as nutritious as the long or specially cut macaroni, and for soup it is just as satisfactory as the long pieces.

A recent product of the canning and macaroni industries is canned spaghetti. To be suitable for canning the spaghetti must be first dried; it cannot be canned freshly prepared. Whether sun-dried or cabinet-dried spaghetti is preferable for canning is yet an unsolved question.

Characteristics of a Good Macaroni

The best macaroni is hard, brittle, translucent, and elastic, and has a rich amber colour. It should be pliable, and the long pieces should be capable of being considerably bent. It should break with a clean glassy fracture. Macaroni of inferior quality has a dull colour, often grey. If made from bleached flour it will be white. It will break unevenly and with ragged ends.

If made from semolina or farina, a good macaroni will have a more or less rough surface instead of being smooth,

View in the Agnesi Machine Room Showing Macaroni Presses and Drying Racks.

and it will have a few bran specks. Macaroni made from flour, even durum flour, is generally considered inferior to that made from semolina or farina. It is brittle but dull in appearance.

A good macaroni should contain at least 2 per cent. nitrogen and 0·5 per cent. ash. If analysis shows that the macaroni contains less than 1·7 per cent. nitrogen and less than 0·55 per cent. ash it is not a durum or a hard wheat product. If the content of ash is more than 0·55 per cent. but at the same time the macaroni gives a greyish residue when treated with an alcohol-ammonia mixture, the indications are that a clear flour has been used.

The real test of a macaroni is its behaviour on boiling. When boiled for 10 minutes a good macaroni will swell to at least twice its original size, will retain its tubular shape and firmness, will not become pasty, and will have an agreeable odour.

Composition

The composition of macaroni is similar to that of the semolina or farina from which it is made. An average composition is: Moisture, 11 per cent.; protein, 11 per cent.; fat, 1·2 per cent.; ash (salt free), 0·60 per cent.; fibre, 0·25 per cent.; nitrogen-free extract, 76·45 per cent.

Food Value

Macaroni products made from semolina and farina, which are essentially free from fibre, are easily digestible, and therefore they are often prescribed by physicians for invalids. Farina and semolina are frequently looked upon as foods especially fit for children. In fact, they are among the first starchy foods infants are permitted to eat.

Effect of Storage

When properly prepared and dried, macaroni products contain, as a rule, less than 13 per cent. moisture, and often as little as 9 per cent. They will keep for a long period without deteriorating if stored under good conditions—*i.e.*, in a cool, dry place.

If macaroni becomes musty on long storage it is either because the product itself contains too much moisture or because of bad storage conditions—for example, a warm, damp storehouse. Infrequently macaroni becomes infested with weevils, but insects do not as a rule gain access to it when it is well prepared and well packed.

New Light on TIMBER DECAY

INFESTATION of structural timber in a food factory by insects or fungi can be a very serious matter, since for various reasons the cruder methods of control by fumigants and antiseptics are frequently impracticable. It is important, therefore, to ensure that only the most resistant timber is employed.

An interesting paper has recently appeared (*Annals of Applied Biology*, 1933, p. 661) which casts a new light on the prevention of decay in timber. Briefly, the experimental work there recorded indicates that the liability of wood to attack by certain wood-boring beetles and by certain fungi is proportional to the amount of starch remaining in the sap wood

Many plant tissues, of course, contain starch; not only reserve tissues—*e.g.*, potatoes—but also other parts of the plant, such as leaves. Those who have studied botany will remember that a leaf, if decolorised with alcohol and treated with iodine solution, gives the characteristic blue colour indicating starch. If, however, the leaf is kept darkened for some hours before removal from the plant, no starch is to be found.

Little attention has been paid previously to the presence of starch in sap wood, but it is easily demonstrated by the iodine test. If timber when felled is allowed to lie in log form, the starch gradually disappears, as in the experiment with the darkened leaf; a much longer period is required, varying with the type of tree and other circumstances. Modern methods, such as rapid "conversion" of the felled timber, kiln drying, or steaming, all check this disappearance of the starch, which is unaffected by any subsequent seasoning treatment.

Experiments are recorded with *Lyctus* beetles. These are the "powder post" beetles, which attack oak, ash, sweet chestnut, and to a lesser extent willow and walnut, but not coniferous wood. Eggs laid in spring in the sap wood pass through the stages egg—larva—pupa—beetle, and the young beetles tunnel their way out the following spring. Very convincing evidence is adduced to show that the *Lyctus* beetles only attack wood which is not depleted of its starch. Planks cut soon after felling, and therefore containing starch, were also found to be much more susceptible to attack by certain staining fungi than were log-seasoned planks.

The principle involved seems to be of considerable importance, though further tests with other insect and fungal pests are highly desirable. A simple iodine test suffices to show whether timber is liable to attack, and log seasoning should be usually practicable once its value is demonstrated. Incidentally, prolonged immersion in water, such as is practised in some parts of the world for the storage of wood (the principle is to prevent insect and fungal attack by excluding air), also removes the starch and renders the wood immune from *Lyctus* attack.

The author of the paper advocates log seasoning as a means of rendering timber immune. He does not suggest an alternative, but if the time factor should be an objection there would probably be no serious difficulty in removing the starch by a more rapid enzymatic process.

YOGHURT

Bulgaria : Land of Yoghurt.

The following account of the preparation of Yoghurt, Yohourt, Yoghourt, Yahourth, Jugurt, or Bulgarian Sour Milk, has been specially compiled at our request by J. McClemont, B.Sc., of the National Institute for Research in Dairying, in answer to an enquiry received from a reader of "Food Manufacture."

YOGHURT, OR Bulgarian sour milk, is the fermented milk drink studied and recommended for use by Metchnikoff, who suggested that the remarkable longevity of the inhabitants of some areas of the Balkans and of Turkey was due to the general household consumption of large quantities of this fermented product, made in these countries from goats', buffaloes', or cows' milk.

Lactobacillus bulgaricus is the organism which is mainly responsible for the flavour and entirely responsible for the acidity of Yoghurt, and, while the true Bulgarian product is probably in many cases not a pure culture of this organism, the contaminants play a very minor part, probably doing little more than imparting a slightly fuller aroma. Under suitable conditions *L. bulgaricus* is capable of growing very rapidly in milk, producing a soft creamy curd and raising the acidity to as high as 3·7 per cent. of lactic acid, although as a rule the lactic acidity does not exceed 3 per cent. The optimum temperature for growth is between 40° and 45° C.

At one time it was commonly supposed that the *L. bulgaricus* became established in the intestine, thus displacing and replacing the normal and supposedly harmful putrefactive flora. Recent work, however, has indicated that this is a mistaken idea arising out of the resemblance of *L. bulgaricus* to a closely related organism *L. acidophilus*, which is a normal intestinal inhabitant and which appears, in some instances at least, to increase greatly in numbers in the intestine if a milk diet is adhered to, particularly if supplemented by the addition of lactose and dextrin. In view of the fact that *L. acidophilus* is a normal inhabitant of the intestine, and that in culture in milk a pleasant acid flavour results, it was suggested some years ago in the United States of America that this " Acidophilus milk " might have at least as valuable a therapeutic action as Yoghurt or Bulgaricus milk. Acidophilus milk is now on the market in America and, to a less extent, in this country. It makes a very pleasant and refreshing drink, which is more palatable to some than the Bulgaricus milk and has in fact to a great extent eclipsed it.

The preparation of Yoghurt on a commercial scale is possible provided it is realised that laboratory technique

is required to maintain the purity and vigour of the mother culture, and that considerable experience and skill are required to control the acidity and produce a palatable product for sale.

The Preparation of the Mother Culture

The function of the mother culture is to maintain the purity of the commercial product by providing a pure vigorous starter for each day's batch of Yoghurt.

In order to start a mother culture, the *L. bulgaricus* must be obtained and cultivated until it has reached its full vigour. The foundation culture may be obtained in powder or tablet form for the initial inoculation, but in view of the fact that the life of the organism as a dried culture is short, some disappointment may follow attempts to found a mother culture from these preparations. Pure cultures in liquid form, whose purity and vigour can be depended on, may be obtained from bacteriological laboratories in which stock cultures are kept. The milk used must be the cleanest obtainable.

Having obtained a culture, this must be inoculated into sterile milk. The vessel in which the mother culture is prepared will depend on the amount required; a convenient container of the smaller type is the ordinary pint or quart size milk bottle or, better still, the standard pattern conical flask which can be obtained in almost all sizes.

The procedure is as follows:

1. Boil the necessary quantity of milk for the mother culture (1 to 2 per cent. of the quantity of Yoghurt to be sold) for at least 1 hour.
2. Cool to 40° to 45° C. (104° to 113° F.).
3. Add the *L. bulgaricus* culture and mix thoroughly.
4. Incubate at 40° to 45° C. for 24 hours, shaking occasionally for the first 8 hours to mix. This shaking is more necessary where the foundation culture is in powder or tablet form.

At the end of 24 hours the resulting mother culture should show a soft, creamy curd with a clean, strong acid taste and smell, a proportion of which is used as 3 above to continue the mother culture according to the instruction shown in 1, 2, 3, and 4 above. The remainder of the mother culture is used to inoculate the milk intended for sale as Yoghurt.

Preparation of the Milk for Sale as Yoghurt

A mixing tank in the form of a small jacketed cheese vat or starter can, with tightly fitting metal lid and agitator, will be necessary. In this tank the milk will be heated, cooled, inoculated, and perhaps incubated, or, if preferred, it can be bottled and sealed immediately after inoculation. But whatever method is adopted, both ***mixing tank and bottles must be sterile*** in order to minimise the possibility of contamination and consequent deterioration of the product during incubation, storage, and distribution. As in the case of the mother culture, the milk must be the cleanest obtainable.

1. Boil the milk to be used for ½ to 1 hour by passing steam through the jacket.
2. Cool to 40° to 45° C. (104° to 113° F.).
3. Add and mix thoroughly sufficient mother culture to cause coagulation to a soft, creamy curd in 3 to 4 hours (usually 1 to 2 per cent. is sufficient).

4. (*a*) Incubate in the mixing tank at 40° C. till a soft, creamy curd is just formed.	4. (*a*) Fill into bottles and seal.
(*b*) Break up the curd and fill into bottles.	(*b*) Incubate in an incubating room at 40° C. until a soft, creamy curd is just formed.

5. Cool to 5° C. to arrest acid development and store till ready for distribution.

There are some who advocate pasteurising the milk, but the temperatures for pasteurisation which have been advocated vary considerably. In the experience of the writer even clean milk requires to be boiled if consistent flavour and palatability are to be maintained.

Some people have advocated the use of mixed cultures to increase the palatability. Where this is done, two or more mother cultures must be maintained, as the temperature of incubation of *L. bulgaricus* is 45° C. and that of most other milk inhabiting aciduric organisms is in the region of 37·5° C. The bulk milk requires also to be split, incubated separately, and mixed after incubation preparatory to distribution. Such a procedure introduces unnecessary complications for a doubtful improvement in flavour and at least doubles the possibility of deterioration due to contamination of the mother cultures.

This description deals almost entirely with Yoghurt and its preparation, but Acidophilus milk may be prepared from these same instructions if one important fact is kept in mind, namely, that the temperature of inoculation and incubation is 37·5° C. It should also be noted that *Lactobacillus acidophilus* can only be obtained in liquid culture, as attempts to produce viable cultures as dry or semi-dry preparations have up to the present been complete failures.

There is no doubt whatever that, with proper precautions, palatable commercial preparations of fermented milks can be marketed and that, aside from any possible therapeutic value, there can be no questioning the fact that they are nutritious and refreshing and that their use might well be encouraged from this point of view alone.

FISH SMOKING

STUDIES have been made in the control of temperature, humidity, and smoke in the preparation of finnan haddie. At 100° F. and a relative humidity of about 60 per cent., it has been shown that finnan haddie can be produced containing an average of 72 per cent. moisture. This moisture content is 5 to 10 per cent. higher than the average commercial product, and means considerable saving to the smoking firm in that it reduces losses.

Following the success of the ethylene gas treatment in the U.S.A., it has been introduced into Australia, South Africa, and the West Indies.

The following account by George Robson, B.Sc., is based on experience gained in the technical development of the process in South Africa.

COLOURING ORANGES

A CONSIDERABLE proportion of the oranges imported into England have received a special treatment in order to enhance their appearance. The treatment consists of exposing the fruit to certain gases which accelerate the natural colouring process. Ethylene, which occurs in low concentrations in ordinary illuminating gas, is most generally used for colouring oranges. Other gases, closely related chemically to ethylene—*e.g.*, acetylene and propylene—have a similar effect on oranges, but are rarely used because of various practical disadvantages.

Objects

There are several reasons why oranges are artificially coloured. In certain citrus growing regions of the world some varieties of oranges mature internally before the skins assume a full yellow or orange colour. This is true of the Satsuma orange in Alabama and of the Washington Navel orange in certain parts of South Africa. Consequently, to market such fruit at its best eating quality, it must be coloured. Another well-known orange, the Valencia Late, exhibits a detrimental colour peculiarity. Under certain conditions, possibly associated with the water relations of the tree, the fruit after developing a normal yellow colour reverts to a greenish-yellow shade, which may be removed by the ethylene treatment. Other reasons include early marketing, uniformity of colour, and improving the market value by raising the grade of the fruit.

On the other hand, artificial colouring may be abused as, for instance, when definitely green and immature fruit is coloured and offered for sale. Fortunately, the public is protected from this deceit by the establishment in most countries of regulations providing for certain minimum sugar-acid ratios before the fruit can be sold or exported.

Development

The discovery of the colouring effect of ethylene is comparatively recent. For many years it was customary to "cure" or colour lemons in America by placing boxes of fruit in air-tight rooms alongside paraffin stoves. Practical men considered that the "curing" was due to the heat given off by the stoves. Two American scientists, Sievers and True,[1] investigated the phenomenon and conclusively demonstrated that the curing was due to the pungent fumes given off by the paraffin stoves and that heat alone played a minor part in the process.

Following this pioneer work, the whole problem was left in abeyance for some years until another American investigator—Denny[2]—took it up and showed the colouring constituent contained in the fumes to be ethylene in

A Citrus Orchard in South Africa.

infinitesimal proportions. Since Denny's discovery the ethylene gas treatment has made great strides, not only in the colouring of oranges and other citrus fruits, but also in the ripening of a variety of fruits and vegetables. For instance, green tomatoes and bananas can be coloured and ripened at the same time by ethylene gas, while mangoes, avocado pears, and persimmons are among the many other fruits that can be artificially ripened by this means. For further information on this subject the reader is referred to the publications of Harvey.[3, 4]

So far as oranges are concerned, practically no ripening accompanies the change in colour. This may be due to the structure of citrus fruits as compared with the other fruits mentioned, but little is known at the present moment regarding the mechanism of colouring and ripening by ethylene. It has been suggested that ethylene acts as an enzyme accelerator. This theory appears tenable in view of minute quantities of gas involved and by a consideration of the biochemical effects produced by the treatment. In the case of citrus fruits, the change from green to yellow is accompanied by the destruction of the plastid pigments, which is simply a hastening of the normal colour change.

Method

The actual colouring treatment is fairly straightforward, although certain conditions of temperature, humidity and ventilation are necessary. Boxes of oranges are stacked in air-tight rooms and ethylene gas introduced in the proportion of 1 cub. ft. of gas to every 5,000 cub. ft. of room space. Ethylene concentrations of as low as 1 in 100,000 have been shown to colour fruit, but for practical purposes a 1 in 5,000 concentration is generally adopted. Various types of rooms are used for colouring, while the arrangements for ventilation and heating are modified to suit local conditions. While all varieties of citrus do not respond identically to the ethylene treatment, it has been found that the process is most successful at temperatures between 70° and 80° F. and humidities between 80 and 90 per cent. Ethylene is introduced at frequent intervals, with periods of ventilation between each gassing. In the most recent American installations, ethylene gas is passed in the required concentration into a stream of conditioned air—*i.e.*, air at the optimum temperature and humidity—and then thoroughly circulated through special insulated chambers by means of an elaborate series of ducks and baffles.

It is very desirable to provide efficient insulation in order to maintain uniform temperatures day and night. Experience in Rhodesia has shown that double walls of insulating material are necessary wherever the chamber comes in contact with the outside walls of the wilting shed, or where the chamber is itself exposed. Other walls and partitions between chambers may consist of a single layer only. The colouring chambers are further insulated by covering their roofs with a thick layer of sawdust.

The question of heating is largely dictated by local climatic conditions. In order to obtain the best out of the ethylene process it is necessary to maintain the temperature between well-defined limits.

Frequent ventilation is necessary in less elaborate chambers, since the respiration of oranges is markedly increased in presence of ethylene, while the colouring process is considerably retarded when the carbon dioxide concentration rises above 1 per cent.

Ventilation

Ventilation is also of great importance. Experience has shown that it is not sufficient to open a door and a few ventilators at each end to ventilate a chamber satisfactorily, but that power ventilation is also necessary. Where electric power is available, at least one fan chamber should be fitted to obtain a uniform distribution of gas inside the chamber. The same fan will also prevent hot air from banking up against the roof and will assist general ventilation. The fan may conveniently be situated in the centre of the roof. If one or two chambers only are to be ventilated, the operation may be accomplished by a suitable type of exhaust fan fitted at floor-level. When a series of chambers are in question it is more convenient to have a central fan connected to the chambers by wide-bore piping. The system adopted in Southern Rhodesia during 1932 is to be recommended. A powerful electric fan forces air through a 12-in. diameter pipe.

Two branches lead from the main pipe into each chamber, the open ends being as close as possible to the floor. Tight-fitting lids operated from outside are attached to the open ends and enable any chamber to be cut off from the air blast at will. The fan supplies 5,000 cub. ft. of air per minute, hence the air may be changed within a few minutes in any chamber.

If it is impossible to arrange for mechanical ventilation of any description, the chamber should be ventilated as frequently as possible by opening all doors and ventilators. In this respect the orientation of the chambers with respect to the prevailing wind is important. Naturally, if the chambers can be arranged to take advantage of the wind, ventilation will be greatly assisted.

Ethylene should be introduced into the centre of each chamber at floor-level through half-inch piping, although there is no strong objection to just a short tube leading into the chamber at some convenient spot. A special measuring device is recommended in preference to the constant flow type of instrument.

Capacity of Chambers

The capacity of the chambers may be limited by the design of the buildings in which they are erected; for general purposes a capacity of 3,500 to 4,000 cub. ft. is suggested. The dimensions adopted in Rhodesia are approximately 6 ft. 6 in. by 20 ft. by 32 ft.; such a chamber will easily hold 800 field-boxes. There is no advantage to be gained by having the roof more than 7 or 8 ft. high.

Location

The most convenient situation for colouring chambers is in the pack house, alternatively in a building close by. The illustrations on the next page show the arrangement in S. Rhodesia; the wilting space of each pack house is entirely occupied by chambers. For obvious reasons it is desirable to operate the chambers with the maximum economy of time and labour. The layouts shown in the figures seem to be the most efficient for the respective types of pack house. An interesting innovation is the replacement of the insulated board at each end of the chambers leading into the pack house proper by heavy canvas. The whole end may be rolled up when desired, thus facilitating loading as well as improving ventilation.

Fumigating an Orange Estate in Umbali.

Costs

Since the entire crop of a particular estate in Southern Rhodesia was ethylene treated in 1932, the operating costs are presented as a matter of interest:

	£	s.	d.
Ethylene gas (10 cylinders containing 2,400 cub. ft)	22	10	0
Transport charges (from England to Southern Rhodesia, plus cost of returning empty cylinders)	36	15	7
Depreciation (an arbitrary figure based on the life of the chambers and equipment)	108	8	2
	£167	13	9

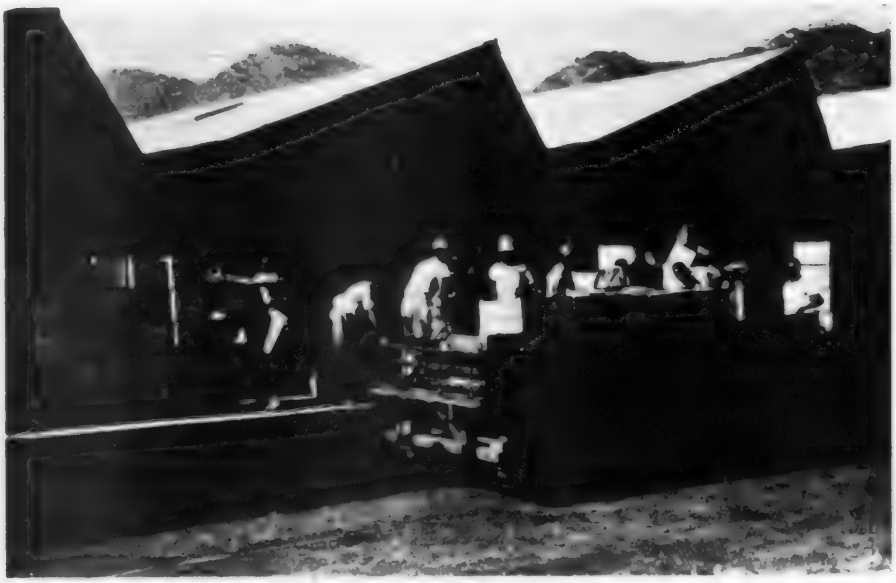
Total number of boxes of oranges exported, 113,492.
Average cost of treatment per export box, 0·354d.

It is probable that a slightly longer treatment would have further enhanced the colour of the Valencia crop, but the time of treatment was limited by the number of chambers. Assuming that twice as much gas had been used, the average cost of treatment per export box of fruit would still have been but a fraction of one penny.

The cost of ethylene gas alone was exceedingly small. No exact figures are given as to the cost of the chambers themselves, since these vary according to labour conditions, material used, and the nature of the chambers.

It is false economy to erect cheap chambers with poor

Loading an Ox-Waggon with Oranges for Transport to the Packhouse.



Unloading Fruit at the Packhouse prior to Stacking inside the Colouring Chambers which are situated immediately behind the Unloading Ramp.

insulation and insufficient means of ventilation. It is also desirable to heat the chambers unless temperature conditions happen to coincide approximately with those recommended.

Apart from the initial outlay comprising the cost of chambers and equipment, the ethylene treatment is quite inexpensive in operation. Growers will quickly reap the benefit from the all-round improvement in colour and standard of their fruit as a result of the ethylene treatment.

Other Considerations

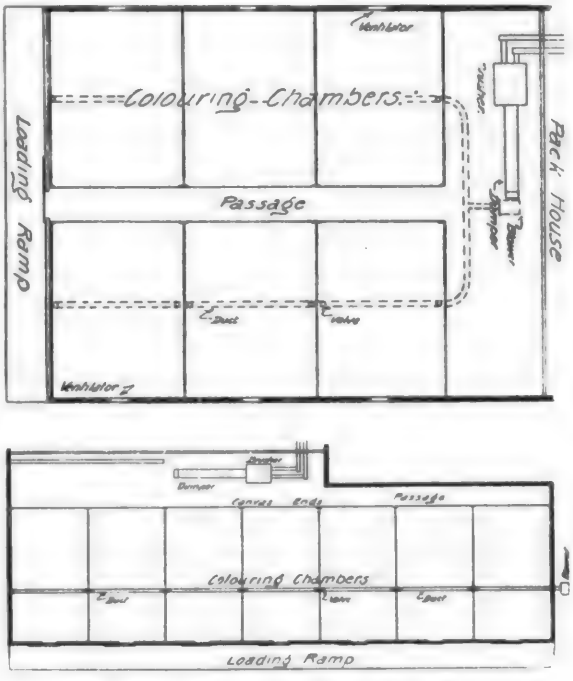
Colouring is retarded by oil sprays. Jaffa oranges sprayed with a proprietary oil preparation for red scale two months before picking were most difficult to colour. Valencias that have reverted to a green colour, generally around the stem end, require longer treatment than normal fruit.

Attention must be paid to the condition of the fruit before picking. Fruit with turgid skin tissues that are liable to bruising and liberation of oil should not be picked in this condition, since oleocellosis blemishes are considerably accentuated by colouring. This was observed on several occasions among Navels picked soon after rain.

There is some evidence that oranges continue to colour after treatment, but the improvement is rather slow and irregular, so that no practical possibilities are offered. Navel and Mediterranean Sweet oranges showed more improvement than Valencias.

Where outside temperatures occur during the picking season, the fruit is frequently hot as it comes into the chambers, and big temperature differences may be found between top and bottom boxes unless efficient means of air circulation are employed. Variations of more than 20° F. are reported from California. Under such circumstances there is considerable danger of the fruit in the top boxes bleaching out before that in the lower boxes has fully coloured. It is therefore very advisable to maintain as uniform a temperature as possible throughout the chambers.

The ethylene process does not appreciably influence the composition of oranges as reflected by the soluble solids : acids ratio. All early fruit should therefore be carefully tested and only treated if the ratio satisfies the standard required by law for that variety.



Plan and Elevation of Colouring Chambers for Ethylene Ripening.

In Southern Rhodesia the Washington Navel, and also to some degree the Mediterranean Sweet, attain physio-

(Continued on opposite page.)

ETHYLENE RIPENING

To the Editor.

DEAR SIR,

With reference to the editorial "Ethylene Ripening" in FOOD MANUFACTURE, Vol. 9, No. 1, 1934, I have pleasure in calling your attention to the fact that the first *experimentally proven* suggestion concerning the mode of acting of alkylenes as well as of acetylene on different cell systems was made by Nord and collaborators in:

Protoplasma, vol. 4, p. 547 (1928).
J. Biolog. Chemistry, vol. 79, p. 27 (1928).
Z. angewandte Chemie, vol. 42, p. 1,022 (1929).
Mechanism of Enzyme Action and Associated Cell Phenomena (The Macmillan Co., London, 1929).
Z. Physiolog. Chemie, vol. 183, p. 218 (1929).
Protoplasma, vol. 11, p. 440 (1930), etc

According to these experiments on yeasts, tobacco, barley, dough, etc., the enzymatic activity was increased, due to the fact that under the influence of minute quantities of ethylene, acetylene, amylene, etc., the *permeability* of cells is increased to a certain extent, allowing in this way a more intense interaction between the reactants and the surface of the enzymes. The corresponding British Patent has the number 291,443.

Very truly yours,

F. F. NORD,

Physiologisches Institut der Tierärzlichen Hochschule, Berlin.

LACTIC BACTERIA

THE importance of lactic bacteria to the food industries requires no stressing. The chief aspect is, of course, their utilisation in the manufacture of dairy products—butter, cheese, and sour milk products—where strict bacterial control is essential for success. Lactic bacteria are also of importance in connection with flour and dough, sugar manufacture, and the preparation of technical lactic acid from lactose, molasses, or glucose obtained from starch hydrolysis. They are also applied in the distillery for the suppression of harmful fermentations.

The property of producing lactic acid from carbohydrates is very widespread among bacteria, but the more economically important "true lactic acid bacteria" are distinguished by the fact that they produce no gas or volatile acids, and, unlike most organisms, they do not possess the enzyme catalase.

In the symposium organised by the Food Group of the Society of Chemical Industry at the end of November, two of the contributors—Dutch and Danish respectively—emphasised the importance to industry of pursuing the "academic" study of the true lactic bacteria; both speakers summarised the results of recent research and pointed out various directions which future work might take.

Professor Kluyver defined the true lactic bacteria by the following criteria: Anaerobic breakdown of carbohydrates to give products including lactic acid, the absence of catalase, and their complex nitrogen requirements which vary for different species. The difficulties of determining the fermentability of various carbohydrates were touched upon, notably the variations introduced by nutrients and by the adaptability of the organisms. As possible intermediates in the conversion of glucose to lactic acid, monophosphoric ester and methylglyoxal are being replaced in modern theory by phosphoglyceric acid and pyruvic acid. It has been found that "aroma-producing bacteria" are necessary to butter manufacture in addition to the main acid-producing organisms; the acetylmethylcarbinol produced by such types is oxidised (by mechanism at present uncertain) into diacetyl, which has recently been shown to be the direct cause of the aroma in butter.

Orla-Jensen, one of the pioneers in work on the lactic bacteria, gave an account of some recent work which still further complicates tests on the fermentability of various sugars. The heat applied in sterilisation was found to affect fermentability, and in many cases sugars sterilised separately from the nutrient (yeast autolysate) were not fermented, though when sterilised together with the nutrient they fermented readily. Furthermore, certain activators, such as methylglyoxal or furfuraldehyde (or pentoses yielding traces of the latter), when heated with the nutrient, enabled the added sugar to be fermented.

Further work on these lines is still in progress, and may still further modify our ideas on the metabolism of these important organisms.

COLOURING ORANGES (continued from previous page).

logical maturity while still more or less green. To colour such fruit artificially is quite legitimate practice, since by these means an orange of improved quality can be marketed. Other advantages of the treatment include the uniform and attractive appearance, improvement in the grade, and in some varieties a considerable extension of the season.

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Stringless Green Beans

The following article, and one on the Canning of Carrots and Beetroots, to be published in next month's issue, are written by Mr. Donald Barr, who has recently returned to America after several years' absence, during which he has acted as technical adviser in canning, first in Russia and subsequently here in England.

CANNED STRINGLESS Green Beans have been packed in varying quantities during the past three years by English canners. There has been a consistent improvement in quality which has created a definite demand for this succulent and highly nutritive vegetable.

Stringless Green Beans are prepared from the fresh, immature pods of certain varieties of Stringless Beans after they have been picked from the growing vine and with the two ends snipped to remove the blossom and tail. The beans are either packed whole, sliced, or cut into lengths.

Varieties

There are numerous varieties of Stringless Green Beans, but those most suitable for canning a high quality product are the round-pod stringless Refugee type. A description of the chief characteristics of these varieties is given in the following:

Rogers' Stringless Green Refugee.

Vine	15 inch., dark, strong.
Pod	5½ inch., round, slightly curved, stringless, light green.
Season	72 days to packing stage.
Seed	Mottled grey, slim kidney shape.

Burpees' Stringless.

Vine	15 inch., dark, vigorous.
Pod	5 inch., round, slightly curved, stringless.
Season	58 days to packing stage.
Seed	Dark brown.

Keeney's Stringless Refugee.

Vine	15 inch., dark, strong.
Pod	5½ to 6 inch., round, slightly curved, light green.
Season	72 days to packing stage.
Seed	Mottled kidney.

Rogers' New Stringless Green Pod.

Vine	15 inch., light.
Pod	5½ to 6 inch., round, stringless, straight pod, green.
Season	66 days to packing stage.
Seed	Similar to Green Refugee, but larger.

There are, of course, innumerable inter-related varieties, and where mass production of cut beans is desired, such varieties as the Giant Stringless are grown almost exclusively because of their heavy yield, while in California in particular the Kentucky Wonder is grown for packing "asparagus" style.

Cultivation

The selection and preparation of soil is most important if the grower wishes to be assured of a good yield of excellent quality. The best soil for growing Green Beans is a medium clay loam or any mixed soil. It is possible to secure an excellent yield from any type of heavy soil providing the drainage is good. To ensure against an extremely wet or dry season, a percentage of the crop should be placed in both a light and a heavy soil, which, under average conditions, will guarantee a good crop. The soil should be well prepared, and prior to planting should be rolled or planked. It is imperative that the temperature of the soil be warm, as bean seed will not germinate properly in cold ground, and, therefore, Stringless Beans are seldom planted before May. About 45 lb. of seed are necessary per acre.

The first picking will, of course, vary according to weather conditions. The average time is from 65 to 75 days after planting. After the first picking, it is necessary to pick each plot of beans at least twice each week. Infrequent pickings will cause rapid deterioration in quality and shorten the period of harvest.

Purchase of Beans

It is advisable to buy beans on a graded basis, as the natural tendency on the part of the grower is to permit

the beans to grow large in order to secure weight. Unless a premium is paid for beans of a certain size, with the larger ones being purchased for a much lower figure, it cannot be expected that the quality of the finished product can be consistently maintained. The ideal situation is for the canner to buy beans on a graded basis with the expectation that 30 per cent. of the beans suitable for canning should weigh 200 beans or over to the lb. About 70 per cent. should weigh between 150 and 200 beans to the lb. Unless a canner has a definite outlet for cut beans, any beans less than 150 to the lb. should be rejected as being too large for packing whole.

Beans should be delivered into the factory in cotton sacks. Burlap bag ravellings adhere to the bean and are difficult to remove.

Snipping

On delivery to the factory the beans are snipped. Mechanical snippers do excellent work, but few packers have production great enough to warrant the investment; therefore, most of the snipping is done by hand either in the factory if space permits or by distribution to private houses in the neighbourhood of the cannery, where the work is done entirely on a piece-work basis.

Grading

After snipping, it is imperative that the beans be processed as rapidly as possible, as deterioration after snipping is rapid. The beans are graded in from two to five grades, depending on the desired quality and style of the finished product. The standard sieves for grading beans are the following:

Size 1.	.. ..	12/64 inch.
Size 2.	.. ..	14/64 ,,
Size 3.	.. ..	17/64 ,,
Size 4.	.. ..	20/64 ,,
Size 5.	.. ..	30/64 ,, and over.

Blanching

For packing cut beans the sizes 4 and 5 are used, and the beans are cut into ¾ or 1 inch lengths by machinery or sliced into lozenge-shaped pieces from ⅛ to ¼ inch in thickness. Following snipping and grading, and after the larger ones are cut or sliced if desired, the beans are ready for blanching, which is usually accomplished in a short cylindrical blancher of the type used for peas. The blanching operation is most important, and great care must be taken to ensure the proper degree of blanching. Over-blanching is most detrimental to the finished product, as it causes softening and a sliminess in the finished product. The time of blanching varies from 1½ to 3 minutes at from 180° to 200° F., and is, of course, regulated by the maturity and size of the bean itself. The purposes of blanching are:

(1) Softening the bean to make it pliable for handling during filling.
(2) Neutralising of colour.
(3) Removing occluded gases.
(4) Removing the outer mucous material from the beans and also performing a general cleansing operation.
(5) Improving the flavour.

Washing

After blanching, the beans must be washed thoroughly with cold water, not only to cleanse and remove all bits of foreign material, but to improve the texture in the finished product.

Filling

While cut or sliced beans may be filled into the cans by mechanical fillers, it is necessary to fill whole beans by hand if high quality is to be maintained. The beans on the top of each can are carefully placed in a parallel position, which gives the finished product an excellent appearance and makes closing much easier. To fill the can as full of beans as is consistent with the maintenance of quality, an average net weight of 12 oz. for A.2's, 18 oz. for A.2½'s, and 65 oz. for No. 10 cans is necessary.

Brining

After filling, the cans are brined by any one of the various systems in use with a 2 per cent. salt solution. The brine to be added as near boiling point as possible; many packers add colouring matter to the brine at this point, but a survey of the preference of the housewife indicates clearly that artificial colouring as used in beans is obnoxious.

Exhausting

While exhausting of small cans after brining is not a necessity, a short steam exhaust for one or two minutes ensures against improper closing temperatures. The average closing temperature should be 160° F. or over.

Retorting

The following processes have been found to be quite sufficient for all varieties of Refugee beans, although minor variations may sometimes be necessary for larger types.

Size Can.	*Initial Temp.*	*Cooking Time.*	*Cooking Temp.*
A.2's	160° F.	20 min.	240° F.
A.2½'s	160° F.	25 min.	240° F.
A.10's	160° F.	40 min.	240° F.

Cooling

Immediately after cooking the cans should be cooled to 100° F. or less, retaining only enough heat to dry the outside of the can.

Labelling

It might be advisable to call attention to the fact that care should be taken in labelling each can right side up, so that it will be opened with the "topped" side up, and therefore present a much better appearance to the consumer.

The preparation of emulsions of the oil-in-water type is well known to food manufacturers, although the literature dealing with water-in-oil emulsions is by no means so conclusive. Interesting information on the latter type is, however, given by Dr. William Clayton in the following article.

BY FAR the greater number of technical emulsions are of the familiar type—oil-in-water (O/W). The opposite type, water-in-oil (W/O), has not received the attention such emulsions merit, and the pure physical chemistry underlying their formation and behaviour seems to have been almost ignored.

In the food industries W/O emulsions are unknown, except in the preparation of margarine, although a salad dressing of such type would no doubt be of much interest and have possible advantages from a bacteriological point of view.

An extraordinary range of emulsifying agents is now available, and many patents are regularly being accepted, almost entirely for the technical preparation of O/W emulsions. Severe limitations are placed on the preparation of edible W/O emulsions, since such accepted emulsifiers as heavy metal soaps, powdered solids (*e.g.*, carbon), and wool-fat are obviously undesirable.

So far as the present writer is aware, the only available (*i.e.*, marketed) and physiologically satisfactory agent for edible W/O emulsions is oxidised vegetable oil. A field of investigation is open, since several questions of a physico-chemical nature remain unanswered. Accordingly, attention is here directed to the matter.

The general rule for emulsifiers is that the agent must be preferentially dissolved, peptised, or wetted by that phase which is intended to be the external phase (or continuous medium). Since the colloid chemistry of non-aqueous systems has received scant study, it is not surprising that W/O emulsions are still somewhat novel.

Schou, prominent in the margarine industry, proposed a simple expedient for producing an agent effective in stabilising emulsions of water or milk dispersed in oil. In passing, it is recalled that milk, by virtue of its proteins, is an excellent agent for the stabilisation of O/W emulsions; a fact which makes the performance of Schou's oxidised oil the more remarkable.

Schou's product[1] is prepared by oxidising a refined vegetable oil—*e.g.*, soya bean oil—at 250° C. until gelatinisation occurs. After cooling to 100° C. the gelatinised

oil is mixed with twice its volume of cold soya bean oil, yielding a pale brown oil of syrupy consistency. As little as 0·5 per cent. of the emulsifier is necessary to be dissolved in the melted fatty phase in margarine manufacture to permit the stable dispersion therein of milk or water.

Fig. 1 illustrates microscopically the effect of agitation on a mixture of vegetable oil and water (ratio 4/1), with and without Schou's product. It emphasises, incidentally, the fact that in the emulsions the *nature* of the fatty phase plays a rôle.[2] The test tubes in Fig. 2 show the same effect.

Important experiments have been carried out by Mohr and Eichstädt.[3] Oil and skim milk (4/1) were mixed at 40° C. with and without Schou's emulsifier and the type of emulsion determined by observing its electrical conductivity. The conductance of a W/O emulsion was 20,000 ohms, the oil being a non-conductor and the continuous phase. The following table gives the results when the oil and the milk were simultaneously poured into the mixing vessel, normally a condition favouring the emulsion: oil-in-milk.

EICHSTADT'S TESTS WITH SCHOU'S PRODUCT.

Oil.	*Electric Resistance in Ohms.*	
	No Emulsifying Agent.	*½ Per Cent. Emulsifying Agent.*
Oleomargarine ..	20,000	20,000
Neutral lard ..	1,375	20,000
Premier jus ..	8,000	20,000
Hardened whale oil	20,000	20,000
Coconut oil ..	1,190	20,000
Hardened arachis oil	2,340	20,000

Accepting, then, the efficiency of oxidised oil to promote W/O emulsions, there is much of interest in the enquiry as to the mechanism of its action.

Smith[4] has observed that cod liver oil on ageing undergoes an oxidation change antagonistic to emulsification as O/W systems. He found that the Donnan drop-number of water falling through the oil increases as the oxidation of the oil advances—*i.e.*, as the tendency towards W/O emulsions grows. Butler[5] has attempted to follow the oxidation changes by measuring the electrical conductivity of cod liver oil itself, but his results do not throw any light on this problem.

The fact that oxidised oils function as emulsifying agents must be attributed to the presence of polar groups in the molecules. In the absence of detailed information on the gelatinisation of refined vegetable oils like soya bean oil, one must infer from the extensive investigations made by numerous workers on the mechanism involved in the oxidation and heat-bodying of linseed oil. Salway[6] advanced the suggestion that the mechanism of the gelatinisation of fatty oils is, (*a*) the liberation of one or more fatty acid radicles, (*b*) condensation of these acid radicles with the unsaturated linkages of the oil. In such a reaction a glyceryl hydroxyl group is liberated, and this condenses to yield a polyglycerol derivative.

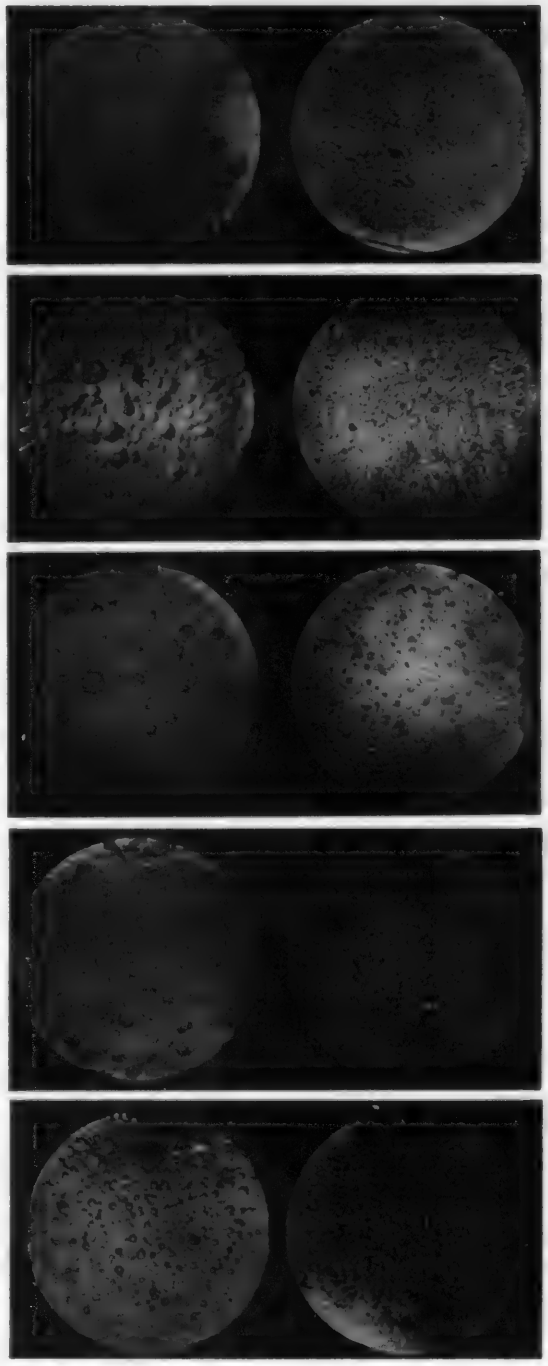


FIG. 1.

On the left-hand side are shown mixtures of various vegetable oils with water, shaken up without the addition of Schou's product. On the right-hand side are shown similar mixtures shaken up after Schou's product has been added.

From top to bottom the slides show: Neutral lard, oleo margarine, palm oil, hardened groundnut oil, and soya bean oil.

The work of Morrell and Marks[7] has established that during oxidation of oils, peroxide groups form at the double bonds.

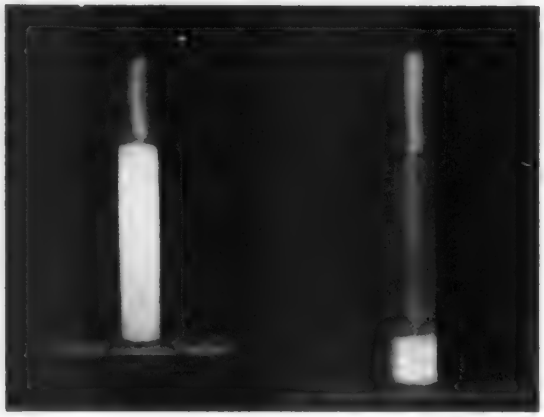
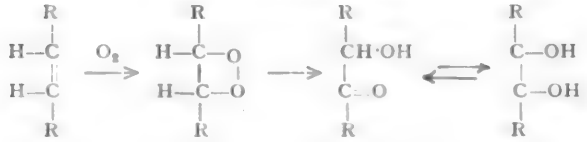


FIG. 2.

After 240 revs. Mixtures of vegetable oil and water, as described on the previous page, with (left) and without the addition of Shou's emulsifying agent.



Long and his associates[8] have given the problem much consideration. He believes that gelatinisation is due to the attraction and association of such polar groups. Association involves secondary attractions, whereas polymerisation or condensation involves primary valence changes. Studying the action of a series of solvents to separate the solid and liquid phases of trilinolenic glyceride films, Long found that those solvents which contained C=O or O–H groups extracted the larger percentages of liquid phase. "The results not only seem to strengthen the general premise of association but, on the basis that 'like dissolves like,' offer specific evidence of the existence of the polar C=O and O–H groups."

The introduction of polar groups means the increased attraction of oxidised oils for water, and investigation by Long with the Langmuir balance on monomolecular films of blown and heat-bodied oils on water surfaces strongly confirms this.

Returning to Schou's emulsifier as a specific instance of an oxidised oil, certain lines of research seem desirable in view of its application as an emulsifying agent. Thus, the change in the interfacial tension of soya bean oil/water boundary as oxidation progresses should be correlated with the development of polar groups. Is this emulsifier capillary-active, influencing the air/oil surface tension of fatty oils? The quantitative investigation of its antagonistic action against the common agents used for edible O/W emulsions (gums, gelatin, proteins, etc.) would be of interest. What actually stabilises the W/O system? Can a protective film be demonstrated at a W/O interface comparable with the evidence of Serrallach and Jones?[9] These authors observed that different oils gave different films with aqueous solutions of hydrophile colloids. Could the progressive changes in an oxidised oil be followed by their technique? What is the interfacial covering power of Schou's product?—in other words, what amount of oxidised oil is necessary in a fatty oil to stabilise a given quantity of water dispersed as globules of known size-frequency analysis?

To the academic colloid chemist this emulsifier offers a suitable agent for the study of the viscosity of W/O emulsions, hitherto an unexplored field for research.

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ORGANIC ANALYSIS

PUBLISHER, editor, and contributors must have uttered a concentrated "Thank God!" when the tenth and final volume of Allen's *Commercial Organic Analysis* was "put to bed." This is the fifth edition of this important work, well known to every chemist. It is, in fact, so familiar to the laboratory worker that nothing we can offer here in the way of criticism would matter one way or the other. Allen is as firmly established as Mellor or Thorpe, and a work of this size, and cost, does not run through five editions unless it has met with general approbation and without undergoing whatever trimming and modification is considered necessary by hypercritical specialists.

Volume X. comprises 817 pages, one-third of which is taken up by the general index to all the volumes. This is the work of M. B. Elliott, M.B.E., and there is no fault to find with it. The first section, by J. A. Gardner and Dr. G. A. Buckmaster, deals with the examination of the blood, and more particularly with hæmoglobin and its derivatives. This is followed by a section on albuminoids and scleroproteins, by Jerome Alexander, which is of interest to food chemists in that it is largely concerned with gelatin.

Next comes a discussion of structural proteins, by W. P. Dreaper and R. H. Marriott, in which the recognition of animal fibres is described.

Another section important to food chemists is entitled "The Examination of Foodstuffs for Vitamins," by Dr. J. C. Drummond and Dr. K. H. Coward, and equally important is the section which has been compiled by Dr. H. W. Burton on the pectic substances.

The two remaining sections are given over to the identification of unknown woods and charcoals, by J. Cecil Maby, and, as a separate chapter, the hormones.

H. B. C.

FOOD COLOURS

Should the Law be Changed?

The argument between those who uphold the present system of a Prohibited List of Food Colours and those who advocate its replacement by a definite Permitted List on the American plan is continued below from two previous issues.

FOR THE PERMITTED LIST

A Manufacturer

WE ARE in agreement with the conclusions contained in the final report of the Departmental Committee of the Ministry of Health on the use of colouring matters in food, which definitely recommends a Permitted List. The Committee was most representative, and investigated the question very thoroughly, examining over 100 witnesses who were in a position to speak with authority for the Ministry of Health, Empire and foreign Governments, the medical officers of health, all branches of food manufacture and distribution both home and export, the chemical and colour manufacturers, and all major interests.

In effect, all reputable colour manufacturers work to the equivalent of a Permitted List; that is, they select for manufacture colours which can be economically produced to the high degree of purity required, and which by virtue of the demand being sufficiently large, warrant considerable expenditure upon analytical control in all stages of manufacture. Colours, on the other hand, for which the demand is small, must necessarily be much more costly if the same standard of purity is maintained. Our experience, from examination of samples of such colours only used in a small quantity, is that they rarely reach the standard of purity of colours which constitute the major requirements of the consumer.

Under the present regulations, except that a colour on the short Prohibited List may not be used, no precautions are specified concerning possible toxic properties of colours which may be used, and the limits of purity are dependent upon the interpretation given by the public analyst to the terms of the Food and Drugs Act, which interpretation might easily lead to a conflict of expert opinion.

The recommendations have not been enforced, but we consider that, with certain modifications, they should be given legal status.

We do not agree that the work of the public analyst is simplified by a Prohibited List. On the contrary, the provision of a Permitted List would make it possible to define precise analytical methods for each permitted colour, and thus avoid the very real difficulty at present experienced in having to devise analytical methods generally applicable to colours of widely different chemical composition.

Of the arguments advanced in your article we feel that the successful operation of a Permitted List in America and most other countries for many years outweighs the fact that a Prohibited List has worked satisfactorily in this country, and that our export trade would benefit in respect of foodstuffs in which artificial colouring matter has been used, particularly if the list could be agreed for inter-Empire trade.

We consider the institution of a Permitted List of such advantage to the export trade that it would be of considerably more importance than the possible inconvenience caused to the manufacturer of food through the adjustments he might have to make in his range of colours, and the dye manufacturer would be compensated for the possible prohibition of certain dyes he has been accustomed to supply by the demand for probably a smaller variety of standardised permitted colours, but in greater quantities of each.

The bulk manufacture of a restricted range would, in our opinion, facilitate working of standards of purity and analytical control, and we question the advantage of " the development of appetising shades " in any greater variety than can be obtained from dyes upon the Permitted List, which has been prepared after careful investigation of the requirements of the trade.

We agree with the observations in the article that if a Permitted List were legalised, provision should be made for its revision from time to time, and that it should be sufficiently comprehensive to give the shades in demand for foodstuff manufacture.

A Public Analyst

There is a good deal to be said for both sides of this question, but I think that on balance I am inclined to the side of the Permitted rather than the Prohibited List. The physiological argument is, I think, an important one.

With the Permitted List it is easy to require that a person introducing a new colour should prove it is harmless, whereas with a Prohibited List there is very little check possible. If an analyst were in possesion of standard samples of permitted dyes he could probably identify any of them when used for colouring foodstuffs, but when, as now, manufacturers are at liberty to use any dye, except a limited number, the analyst makes tests only for the few prohibited ones, and a newly introduced dye might be entirely overlooked.

In a Permitted List we should have a number of dyes, of the physiological action of which we should be pretty sure, and the number could not be added to unless there was definite, positive evidence of harmlessness. The proof of this might be difficult, but the method is more scientific and safer than to assume that all, except prohibited, dyes are perfectly safe as is the position at present. There are such things as cumulative poisons, but it might be very difficult to show under Section 1 and 2 of the Food and Drugs Act that a foodstuff coloured with a dye of such a nature was actually harmful to health. It might easily cause considerable injury without the source of the trouble being even suspected, unless previously tested by competent authorities.

The Permitted List would not assume that all other colours are toxic, but merely that other colours have not been proved to be non-toxic. It is unnecessary to include all known non-toxic colours. Most countries get along very well and manage to satisfy the æsthetic tastes of their populations with a list of a dozen or so, and it is likely that the food manufacturers of this country could produce all the tints necessary to please their customers' eyes by the use of a small number.

In any case, I think that wherever added colour is used it should be declared. There are too many articles masquerading as high-class produce which, if stripped of their colour, could be seen to be definitely inferior, not to say of an entirely different character altogether from what their colour would appear to warrant. A little colour covers a multitude of defects, and it is used for this purpose quite as much as for the legitimate purpose of pleasing the eye and tempting the palate of the consumer.

FOR THE PROHIBITED LIST

A Manufacturer

In discussing this subject, the principal point of view to consider is how the safety of the public is likely to be affected by the adoption of either a Prohibited or a Permitted List.

As an argument in favour of the former, it may be stated that under existing conditions there is, I believe, no proved case of any harm having been caused by the use of dyes in foodstuffs, despite the wide variety of comestibles which now rely upon colours for their attractive appearance. That being so, what reason is there to make any alteration, as protection is already afforded by the prohibition of those dyes known to be harmful, and it is open to the authorities to extend this Prohibited List at any time?

The fact that the U.S.A. have adopted a Permitted List (a notoriously ill-chosen and insufficient one) is no argument at all for the adoption of such by other countries, any more than there would be for copying their recent experiments in the world of economics.

Secondly, from the food manufacturer's point of view, there is not the shadow of a doubt that the adoption of a Permitted List would be nothing less than a "bolt from the blue." In view of the various processes in vogue in the trade, and the many ingredients employed, all of which are likely to have some effect on the dye used, a very wide range of colours to select from is absolutely essential, as it is a well-known fact that one dye will stand up to acid but not to alkali, and *vice versa*, another is fast to light but changes colour or disappears under heat, while other requirements are stability to sulphur dioxide, which has a strong reducing action on almost all organic dyes.

As the very essence of a Permitted List is the restriction of the number as much as possible (as witness the lists of all those countries which have adopted one), it is patent that such a condition would be highly detrimental to the unfortunate food manufacturer, who would find that it would be quite impossible for the dye manufacturer to fill all his requirements from the meagre list of dyes at his disposal. The result could hardly fail to be complaints and loss of trade.

Another point which should not be overlooked is that of price. Where the field of choice is whittled down from the very broad to the very narrow, the natural inference is that many of the cheaper colours will be discarded and that the average price of permitted dyes will be higher than under the present unrestricted régime.

Thirdly, from the dye manufacturer's point of view (perhaps the least important, but, none the less, not to be put lightly on one side): he would, of course, do his best, with the limited number of dyes allowed him, to meet the multifarious requirements of the food manufacturers, but he could not hope to give the latter colours of the exact shade and properties as those which they had been using. The most he could hope to do in many cases of complex mixtures would be to get a match as closely as possible in shade to the colour wanted, quite independent of the fact that it would not be possible generally for the substitute to possess the same fastness properties (to acid, alkali, heat, etc.) as the original product.

From all points of view, therefore, the case for the retention of the existing system of free choice of colours under strict supervision and guarantee is clearly established.

A Food Chemist

Most of the arguments for and against a Permitted or a Prohibited List have been set forth already in your December issue, and it is not easy to add anything new.

On the whole, I favour the present system of a Prohibited List, for the following reasons:

With regard to Argument 1, for a Permitted List, it is better to follow the guidance of our own national instincts than to imitate the procedure of those who may

be less experienced socially and politically than ourselves. Prohibition as a policy is not wise procedure.

With regard to Argument 2, whatever the advantage of an agreement with the Dominions, it does not follow that they would not agree to adopt a more liberal system. As regards both International and inter-Empire trade, the exporting country must conform to the regulations of the importing country, and if this is done, it is difficult to see why a common colour standard will promote such trade.

Argument 3.—The proportion of the colour manufacturers' output used by the food industries is small compared with that produced for other commercial purposes. It is improbable that the position of those who make or purify these colours would be much affected by any change.

Argument 4.—Even if true, this does not meet the objection that the manufacturer might not get the results he desires within the limits of a Permitted List.

Argument 5.—This alleged argument has already been adequately dealt with.

Argument 6.—This presupposes in public and dietician an interest which in the first case does not exist and could hardly be intelligently exercised, and in the second has still to find adequate scientific expression.

If further review of the question is desirable, investigation might be directed more usefully to colours or groups of colours hypothetically less desirable, with a view to adding to the Prohibited List. Real progress would be faster along this line.

Conversely, if we keep gradually adding to a Permitted List colours that have been examined toxicologically, it is probable that in course of time the position would be very similar to that which exists at present.

Another Public Analyst

In considering this question we may try proceeding from general propositions to the particulars of the case. What generalisations can be made about food colours? The following are suggested:

1. Colours shall not be used without declaration to mask inferiority.

2. There is a definite psychological argument in favour of foods being attractively coloured provided that inferiority is not being masked.

3. No possible danger to public health must arise.

Let us examine these in some detail, taking the last proposition first. Everyone will agree that this is a reasonable requirement, but its implications need to be considered a little carefully. It will be agreed that the addition of colouring matters to food is in general a recent development, and in fact dates from the time when foodstuffs began to be largely manufactured instead of being prepared in the home. What is and what is not harmful to eat is all a matter of experience. Primitive men, no doubt, made not a few mistakes and bought their experience dearly, but to-day most people know which of the natural products at least are safe to eat. But what is the position of a manufacturer who comes along and wants to put something entirely new and foreign into a foodstuff he proposes to sell to hundreds and thousands of customers? In an age which claims to be scientific, the onus must clearly rest on him to be sure that his proposed addition is entirely harmless. He cannot say, "I think," or "It's sure to be all right." He must be as certain as he can and have done all in his power to *prove* it to be harmless. In other words, a new addition of any kind to manufactured foods cannot be held innocent till it is proved guilty, it must be guilty until its innocence is reasonably established. I have no doubt that manufacturers generally take this view themselves, and I am concerned here solely with developing an argument and do not wish anything herein to be taken as a reflection upon manufacturing methods.

If the foregoing arguments are valid, then the logical position is that there should be a Permitted List and not a Prohibited List, and such a list might be started on the basis of those existing in America and the Colonies, with the understanding that further colouring matters might be added to it as a case was made out for their harmlessness.

The present legal aspect of this question is governed by Section 1 of the Food and Drugs Act and by the Preservatives, etc., Regulations. It has been held that guilty knowledge is necessary before anyone can be convicted under this section—that is, the substance added must have been known to be injurious. As is pointed out in Bell (*Sale of Food and Drugs*), there is nothing to prevent a prosecution under Section 2 of the Act, however, and here, of course, it is not necessary to prove *mens rea*.

I believe that makers of colours intended for foodstuffs are, fortunately, extremely careful in this country, and that most food manufacturing firms avail themselves of the advice of the colour makers or exercise great vigilance themselves. The present position with a Prohibited List means that we are taking a risk, for it seems fairly certain that such a list is likely to be extended only if outbreaks of illness or worse arise which can be traced to the use of new colouring matters. We are in the hands of the colour makers. While they are careful, we are all right; if they or some newcomers to their ranks are less careful in the future, we may not escape scatheless. It is not my purpose to consider what are the chances of such a happening; I merely wish to point out that if we are gambling the best thing to do is to know it and to do it with our eyes wide open.

Although it seems to me that logically we must be driven to a conclusion favouring a Permitted List, I view with considerable trepidation the effect of such a development upon my own work. Recent legislation has easily doubled the work of a public analyst *per sample*, and he still has to carry on with the same staff and funds. It would be wrong, in my view, to make a Permitted List as short as the American one, for example; and if a reasonable number of colours were permitted (and I would certainly agree that, from a manufacturer's point of view, a reasonable number might easily be a large one), then the examination of foodstuffs to find whether the colours were natural, permitted, or otherwise would be something of a nightmare. For this reason I consider

that we might compromise by keeping the present Prohibited List and introduce the proviso that no person shall colour foodstuffs with any material unless he has taken care to find that the coloured product shall be harmless. This seems to me to put the onus where it logically belongs and the clear enunciation of the principle in our legislation might be a good thing. Indeed, it might well be extended to cover all additions to foodstuffs of materials such as colouring matters which may be termed foreign substances.

The second general principle with which I began is, I believe, an important one, and I also think its importance is not generally realised. If our food attracts us it will do us more good. Physiologists are, I believe, on my side when I say that if our food attracts us we respond with an increased secretion of saliva and digestive enzymes, with the result that the same food attractively coloured may do us more good through being better digested. When we wanted to make my own daughter, aged three, eat blanc-mange, we found that three drops of cochineal meant the difference between success and failure! If the truth of this argument be admitted it at least disposes of the contention that no foods should be artificially coloured. This brings me to the first of my general propositions, and I have left it until the end because I think it is a self-evident truth and it is a proviso to all the foregoing. If the reader agrees with this, he can make for himself the application to the present jam standards!

I therefore favour the retention of the principle of the Prohibited List (with, of course, power to "co-opt" any colours which further experience shows should be placed upon such a list), but only if, in addition, we have the user's responsibility for new additions clearly enunciated.

Another Food Chemist

The chief advantages of a Permitted List from the food manufacturer's point of view would appear to be: (*a*) The uniformity, as regards colours, of home trade and export products; and (*b*) the elimination of responsibility in choosing a dye for foodstuffs. To a large extent, however, a manufacturer can obtain these advantages under the present system by the use of only the restricted number of dyes permitted in many countries and by the purchase of guaranteed food colours.

On the other hand, the imposition of a Permitted List would entail considerable revision in recipes and methods not only to produce satisfactory tints, but to obtain colours stable to manufacturing processes and unaffected by light and constituents in the food. In the event of the product being less attractive in appearance it is conceivable, especially with luxury foods, that there would be a diminished demand.

The prohibition of many colours now used, unless for sound physiological reasons, would not therefore appear to be justified.

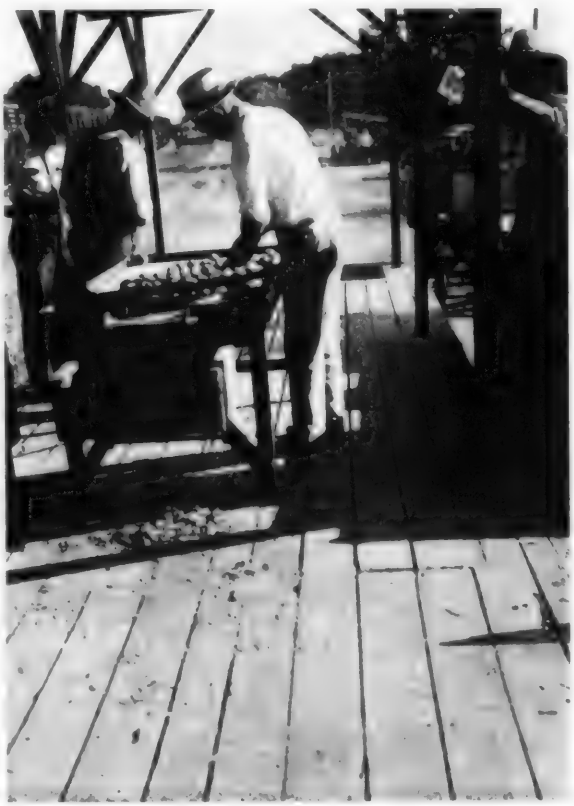
Lime Marmalade

QUITE recently we received an enquiry from one of the colonies for information on lime marmalade. We understand that this was made in England for many years, but had not a large sale. It appears to have been made about 38 years ago in Kent, together with a compound lime-and-lemon marmalade. A suggested recipe is as follows:

Limes (ripe)	..	..	..	28 lb.
Sugar	..	..	..	56 ,,
Water	..	..	..	4 gal.

Immerse the fruit in hot water. Cut in half and remove the dummies. Cut the peel as for marmalade. Boil the chips for an hour until quite soft and strain off the water, which is discarded. Place the dummies in a steam-pan with the 4 gal. of water and simmer until the pips are easily removed. Then pass them through a sieve (8 mesh). Add the chips to the pulp. The total amount of pulp should now be about 4 gal. Add 2 gal. of water to the pulp. Then add the sugar to boil to 222½° F.

In the case of lime and lemon marmalade, 18 lb. of lemons and 19 lb. of limes might be used.

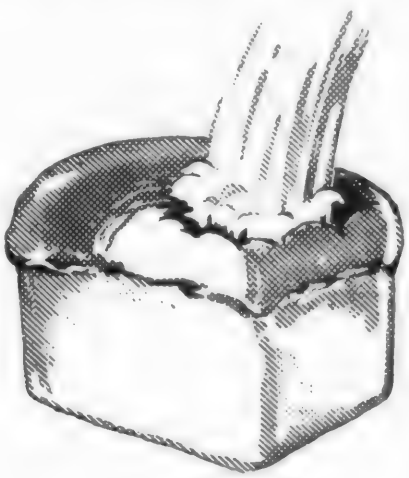


Californian Peaches.—The illustration in the opposite column shows the inspection at the shipping point of peaches intended for export.

MILK in BREAD

By "Ignoramus"

THERE HAS recently come to the fore a proposal to encourage, or indeed to make compulsory, the inclusion in bread of a certain amount of dried milk. The proposal is not a new one, and has been advocated on several grounds—economic, dietetic, agrophile (this means love of the farmer, presumably!—ED.), and æsthetic (since some people insist that milk bread tastes nicer than water bread). Of late publicity has been given to the proposal from various quarters, and it was mentioned in passing by Professor H. D. Kay, in reading the first paper at the "Bread and Milk" Symposium of the Food Group of the Society of Chemical Industry in November last. The matter was only referred to by one speaker in the course of the discussion, and some of his calculations were a little at fault, possibly due to haste. The matter is one of some public and considerable technical interest, and I propose here to consider, as far as my information permits, the facts relevant to the proposal, and to make such calculations as these facts allow.



First of all, it must be remembered that a stimulus has been given to this proposal by the fact that a similar procedure has now been made compulsory in Germany. Apart from all questions of principle and the desirability or otherwise of Hitlerising our bread, we should not necessarily be influenced by a move admittedly made without any special consideration for public health. Everybody concerned either with the baking or the milk-product industry in Germany knows perfectly well, and is quite frank about it, that the step was taken in order to assist the farmer. The miller or baker is compelled by law to include a certain percentage of separated milk powder in his flour and is not allowed to increase the price of the flour or bread so treated. Apart from the problem, to be considered later, of the dietetic benefit conferred by this measure on the German public, the net result of the step is a subsidy for the milk producer paid under compulsion by the miller or baker. Although it is true that certain economies in bread manufacture result from the addition of milk solids to the dough, we shall see later that the compensation is not sufficient to pay for the whole of the milk solids.

Let us first of all consider this matter from the point of view of milk requirements. The actual proposal mentioned by Professor Kay at the Symposium was to add from 4 to 6 per cent. of dried milk, dried whey, or dried skim milk to flour. In order to simplify matters, it will be assumed throughout this article that the addition will be approximately 4 per cent. of separated milk solids to the flour, and therefore 3 per cent. of these solids to the finished loaf, since the loaf will be taken to contain 40 per cent. of moisture. It is a generally accepted figure among milling and baking experts that the average daily *per capita* consumption of bread in this country is not less

than 8 oz.; for purposes of approximation we shall take this figure and a figure of 45 million for the present population of the country. This gives a daily bread consumption of 22½ million lb., or almost exactly 10,000 tons; 3 per cent. of this figure corresponds with 300 tons of fat-free milk solids, which are contained in almost exactly 800,000 gallons of liquid milk. According to recent statements in the press, the Milk Marketing Board will have 40 million gallons a month surplus liquid milk available by next spring, and this will provide considerably more than the necessary daily amount required for the "lactification" of the whole of our daily bread. On the other hand, no figures are available to show whether the average daily surplus throughout the year would provide the necessary amount of milk solids; such information as I have received from dairy experts certainly suggests that any surplus milk likely to be available in the immediate future, unless special measures are taken to increase production, would not reach an average daily amount of 800,000 gallons.

If that is so, suitable means will have to be found to encourage the production of this surplus, and to make it available to the milling and baking trades in a form suitable for its incorporation in bread, presumbably by drying. In the course of this procedure a very large amount of cream or butter fat will be produced, and it is a matter for the agronomic experts to decide, first, whether the regular production of this amount of surplus milk powder is practical politics, and, secondly, what is to be done with the surplus butter fat. It is, on the other hand, a problem for the dieticians and publicity experts to decide whether the amount of energy and organisation necessary to produce this surplus, and to put it into people's stomachs via their daily bread, could not be used to greater advantage and with more direct benefit in a "drink more milk" campaign.

And, finally, on this particular point, if it be argued that there is no need to make the addition of milk solids to bread compulsory, that all we really require is to encourage this procedure to the utmost of our ability, then I can only say that the proposal is almost certain to fail, for reasons to be discussed below.

Effect on Nutritive Values

The next point we have to consider is the dietary one. Would the daily addition of the milk solids from 800,000 gallons of milk to 10,000 tons of bread appreciably affect the nutritive value of the bread? Since, as we have seen, the amount of milk solids required would be derived from 800,000 gallons of milk, if we assume that non-fatty milk solids lose none of their nutritive value—protein, carbohydrates, vitamins, and mineral salts—during drying and baking, it is clear that the extra milk solids consumed *per capita* in the daily bread will be obtained from about ½ pint of separated milk. When the figures for milk consumed in this country, the lowest in the world, and Scandinavia, the highest in the world, are considered, and it is found that they are respectively ½ pint and 1½ pints per head per day, I do not think it can be seriously argued that this ½ pint will be of much effect in bridging the appalling gap.

In order to pursue the matter further it is necessary to take into consideration a further set of facts. It is well known in the baking industry that the addition of milk solids to flour or dough enables the final loaf to hold more moisture. Indeed, I have been informed that this argument is actually used by the manufacturers of dried milk in attempting to sell their milk to the millers and bakers, and it is on this basis almost entirely that a campaign for milk bread has been waged in the United States. However that may be, the technological facts are probably well established, and it can be safely taken that every pound of milk solids added to flour enables the final loaf to hold an extra ½ lb. of water. Now a sack of flour weighs 280 lb., and makes 375 lb. of bread on the average. If to this flour are added 12 lb. of milk solids, just over 4 per cent., the amount of bread made will be increased not only by that 12 lb., but by the extra 6 lb. of moisture held in the loaves. Thus 393 lb. of bread will be obtained instead of 375 lb., and this bread will have in it almost exactly 3 per cent. of milk solids.

According to the recent report on nutrition by a special committee of the British Medical Association, the mean price for bread in the South of England is 3½d. per 2-lb. loaf. This means that a sack of flour normally brings the baker 656d., the return for 187½ 2-lb. loaves. The use of the milk solids will give him 196½ 2-lb. loaves; if he sells these at the same price as before, he will obtain 688d., which is 2s. 8d. more than he got before. What is it going to cost him to do this?

Extra Cost

We will put on one side altogether any capital expenditure involved by the alteration of his baking processes, and simply take into consideration on the debit side the cost of the milk solids. Under present conditions it is difficult to see how he is likely to be able to obtain 12 lb. of milk solids for much less than 5s.; if the compulsory lactification of bread results in the production of so much separated milk powder as to bring the price down, it seems likely to defeat its own object. Nevertheless, we will assume that, after due equilibration of economic forces, there is a slight fall in the cost of dried milk solids, and that 4d. per lb. becomes an average price. The baker will thus need to pay an extra 4s. for the dried milk to be used with a sack of flour; we have already seen that he will get 2s. 8d. of this back from the extra number of loaves he produces. Who is going to pay the 1s. 4d. difference?

In this connection, it is relevant to quote a recent paper by Larsen in a Norwegian journal (abstracted in *Nutrition Abstracts and Reviews*, Vol III., July, 1933, p. 97). According to the abstractor, Larsen states that "total replacement of water by whey or skimmed milk, and half replacement by skimmed milk, gave a bread of superior quality, but the increased quantity of bread from a given weight of flour was not sufficient to give an adequate return for the cost of the whey or milk."

Difficulties Ahead

We have thus already arrived at an impasse. If the addition of milk solids to bread is left optional, it will

not be carried out except by those bakers who feel that they can charge more for the milk loaves; they will certainly not be prepared themselves to shoulder permanently the extra cost of 1s. 4d. per sack of flour. If it is made compulsory, the milling and baking trade will naturally insist upon the right to increase the price of the bread. Even though the baker, at certain times most favourable to him, may have "something in hand" from a recent increase in the cost of bread more than sufficient to cover a temporary increase in the cost of flour, there will be other occasions when things will work out the other way. Unless the baker is, on average, to get reduced profits, he must, on average, charge more for his bread if he has to put up his raw material costs. It is clearly in itself undesirable that there should be any increase in the cost of a foodstuff that constitutes the main source of calories for the majority of the population; in any case, it is pertinent to ask what the consumer will get in return for the extra cost.

The smallest increase possible with our currency is ¼d. per 2-lb. loaf. This will bring to the baker on 393 lb. of bread per sack an extra 4s. 1d. Consequently, his possible total increased receipts per sack will be 6s. 9d., while his increased expenditure will be 4s., with a net increase in receipts of 2s. 9d. per sack, so the baker will have nothing to complain of. What of the public?

The Loaf: Its Composition

This question cannot be answered without considering in a little more detail the composition of the loaf. We can take as the average composition of ordinary white English household bread—water 40 per cent., protein 6·5 per cent., fat 1 per cent., starch and other carbohydrates 51·5 per cent., and mineral matter 1 per cent. This gives a calorific value of 247 to every 100 gm. of bread, or approximately 2,250 to a 2-lb. loaf. The total calories present in 375 lb. of ordinary bread will therefore be approximately 422,000. To this must be added the calorific content of 12 lb. of milk solids; at 1,770 calories per lb., this amounts to 21,250 calories, bringing the total calorific value of the lactified sack to 444,250. This is now, however, distributed over 196½ instead of 187½ loaves, so that the calorific value of each milk loaf becomes 2,255, an increase in 5 calories for every 2-lb. loaf, consumed on the average in four days! It does not need any profound knowledge of dietetics to see that this is not worth the extra money. By similar processes the increase of protein and carbohydrate could be calculated, but it seems quite obvious that they will be negligible quantitatively. The only qualitative improvement made to the bread would appear to be the replacement of a small amount of flour protein by the relatively "good" protein of separated milk, and a simultaneous increase in the mineral, especially the calcium and phosphorus, content of the loaf, the latter being perhaps the only improvement of any importance, since the total ash content of separated milk is about 6 per cent., whereas that of bread is only 1 per cent.

The above considerations seem to me to dispose finally of the allegation that any really serious dietary advantages would accrue to the majority of the consumers if 4 per cent. of milk solids were added to flour used in bread making. In view of the fact that, *ex hypothesi*, those consumers are already living at a low subsistence level, where increased expenditure on the food is out of the question, it seems quite clear that the effect of this proposal, unless the baker can be compelled to pay for the extra cost of the loaf, will be to *reduce* the consumption of bread amongst the poorer parts of the community, with no counterbalancing benefit to them. Since the increased cost cannot be less than ¼d. on every 3½-lb. loaf, and will be relatively about twice that amount on the 1-lb. loaf, it would seem as if the reduction in the intake of calories and of the food constituents present in bread would have to be in the neighbourhood of 7 per cent. Those who advocate the lactification of bread on public health grounds are inclined to argue that, since the poorly paid worker cannot afford to spend any more money on milk or other foods, it is highly desirable to divert into his stomach a surplus of the milk at present being wasted, and that this can be done without extra cost to him or the community by compelling the inclusion of milk solids in bread. The figures we have already given seem to me to establish a real dilemma for those who argue in this manner. For there is probably not available at present enough milk to do the trick, and even if there were, the step could only be taken without cost to the consumer if either the baker or the public paid out the resultant increased cost of bread. To round off our survey of the problem, it is therefore necessary to consider the remaining alternative, that of not making the proposal compulsory, but merely encouraging the sale of milk bread against the present water bread.

Conservatism of the Public

It can be said at once that such attempts in the United States are alleged to have met with complete failure. The remarks made by Dr. Kent-Jones at the Bread and Milk Symposium on the subject of standard bread should remind those who may have forgotten that it is only as the result of assiduous and extremely expensive press propaganda that the British public can be induced to change its bread-eating habits. It is theoretically possible that we might be converted from a water bread to a milk bread consuming nation by a vast press campaign, and kept on the changed diet as long as the campaign persisted; it is even arguable that the campaign might be decreased in intensity as a new national habit was being formed. We do not know how long this would take, but we do know that it would cost an enormous amount of money. Could it not be spent in a more effective attempt to improve public health and nutrition? To those who say that this campaign would not be necessary, since milk bread is more palatable than water bread, one can only reply that this is a matter of taste, and that it would be extraordinarily unscientific to embark on so far-reaching a proposal with no more security than that which depends upon some men's view of other men's palates.

(*Continued on page 76.*)

DISINFECTANTS AND FOODSTUFFS

A DISINFECTANT may be defined as a chemical agent which is actually capable of killing microbes. Progress in hygiene has been so rapid that it is difficult even for the present generation to realise that only within its own lifetime have micro-organisms or bacteria been recognised as the essential agents in the propagation of infectious diseases and putrefactive processes. The classical investigations of Pasteur, which proved that putrefaction was invariably associated with the presence of micro-organisms, were followed by the work of Lord Lister, which laid the foundations of a rational method of dealing with putrefaction and infected wounds by means of chemicals which were proved to be lethal to the microbes. The first antiseptic used was carbolic acid, and from this beginning was evolved modern antiseptic surgery, the principles of which have still to be applied to tissues infected with bacteria, and utilised for the disinfection of the skin. The improved health of the nation and the absence in these days of virulent epidemics is due solely to appreciation of the dangers arising from microscopic or ultra-microscopic bacteria; and although public health authorities have translated this knowledge into action by taking steps to secure improved sanitation and drainage, and by many other means, there is still much that might be done in the matter of adequate sterilisation of foodstuffs.

In view of the growing use of hypochlorite solutions in the food industry we have obtained the following information from the manufacturers of this type of disinfectant.

Choice of Disinfectant

Various well-defined classes of compounds have the power of killing microbes, but a choice, especially in relation to foodstuffs, will obviously depend on considerations of safety, convenience, and economy in use. The more commonly used disinfectants include reducing agents such as sulphur dioxide and sulphites, oxidising agents such as formaldehyde and disinfectants of the carbolic class. All these disinfectants vary in bactericidal power, and many (such as mercuric chloride and copper salts) are limited in scope owing to their poisonous nature. Hypochlorites, in addition to their powerful disinfectant action, have the great advantages of being cheap, as well as non-poisonous at the dilutions in which they are usually applied. The latter factor is most important where the disinfectant is to be used in conjunction with foodstuffs, and where anything of a poisonous nature must be rigorously excluded; and it is for this reason that the hypochlorites, at reasonable dilutions, are particularly adapted as foodstuff disinfectants.

Hypochlorite Solutions

It was the French chemist Berthollet who, in 1778, first prepared a hypochlorite solution by allowing chlorine gas to act upon a solution of an alkali. Shortly afterwards were evolved the famous *Eau de Javelle*, originally a solution of potassium hypochlorite, which was recognised to be a useful bleaching agent, deodorant, and disinfectant, and the corresponding sodium hypochlorite solution, prepared by Labarraque, and known as "Labarraque's Disinfecting Fluid." The potassium and sodium hypochlorites were later replaced as disinfectants by the more portable calcium compound, "chloride of lime," which for nearly a century has been known as a powerful disinfectant and bleaching agent; in fact, by its use, Semmelweiss stamped out an epidemic of puerperal fever in Vienna in 1846. It is thus interesting to find that hypochlorites were used as a means of preventing putrefaction and the spread of infectious diseases before medical science, through Pasteur, became aware that putrefaction and infectious diseases were due to micro-organisms.

The hypochlorites which are of importance as disinfectants are chloride of lime and sodium hypochlorite, and both find wide medical and industrial application to-day. Chloride of lime or "bleaching powder" is manufactured on the large scale by the action of chlorine on slaked lime, the reaction being carried out either in chambers or in rotary tubes under carefully regulated conditions. So produced, it is in the form of a white powder with a characteristic smell quite different from chlorine, and usually containing 35 per cent. of weight of "available chlorine." Exposure to the air gradually changes it to a pasty mass resulting from absorption of moisture and carbon dioxide, a change which is accelerated by the presence of light and heat, and the result of which is a loss in the "available chlorine" content of the product. The active bleaching and sterilising constituent of chloride of lime is calcium hypochlorite, which is

readily soluble in water, so that hypochlorite solutions are readily obtained from chloride of lime by mixing with water, and allowing the sludge of hydrated lime, silica, and other insoluble matter to settle. Sodium hypochlorite solutions are usually prepared by passing chlorine into a solution of caustic soda. Alternatively, they can be prepared by the electrolysis of brine, or by the double decomposition of a solution of chloride of lime with sodium carbonate. A well-known member of this class of disinfectants is a solution of sodium hypochlorite containing 10 per cent. by weight of available chlorine. The bleaching and sterilising action of hypochlorite solutions depends on the ease with which they part with their available chlorine, so that conditions of storage should be chosen to avoid loss of this. They are best stored in stoneware jars in a cool, dark place, since light and heat are two factors which promote decomposition.

The Action of Hypochlorites

The first stage in the decomposition of such hypochlorite solutions involves the formation of free hypochlorous acid, either by direct hydrolysis, or by the action of carbon dioxide in the atmosphere, or in the water to be sterilised. This hypochlorous acid subsequently decomposes to form hydrochloric acid and nascent oxygen, enabling organic matter of all kinds to be oxidised with extreme rapidity. It was thought until recently that this oxygen was the poison or lethal agent towards the bacteria, but it is now thought that it is the labile chlorine atom which exerts direct toxic action, probably through combination with amino-groups present on the surface of the micro-organisms to form chloramines. These chloramines are extremely powerful disinfectants, and have been used with considerable success in wound treatment. That disinfection is caused by direct action is also supported by the fact that the germicidal power of other oxidising agents is not proportional to their oxygen equivalents; thus solutions of the actively oxidising hydrogen peroxide are not such good bactericides as hypochlorite solutions.

The value of hypochlorites compared with other disinfectants can be seen from the attached table, taken from Thorpe's *Dictionary of Applied Chemistry*, which shows the carbolic coefficients (based on the Rideal-Walker test) for various disinfectants in common use.

Disinfectant.	*Germicidal Value.*
Boric acid	less than 0·1
Copper sulphate (calculated on $CuSO_4$) ...	2·0
Cresylic acid (commercial)	3·7
Formaldehyde	0·55
Hypochlorites (calculated on available Cl_2) ...	146-220
Mercuric chloride	400-3540
Potassium permanganate	42

Application in the Food Industry

Perhaps the best-known application of hypochlorites in the field of sanitation is for water sterilisation. Air and water are the most important items in the diet of the human being, and it is a fact that they are among the most effective germ-carriers known. The germs of such diseases as typhoid, dysentery, and cholera may all be transmitted by water unless methods of sterilisation are adopted. Water is also a source of infection in the manufacture of canned foods, and the maintenance of sterile conditions is necessary if a product is to be obtained which does not decompose on storage. Hypochlorites are of direct assistance in this connection, and, owing to their non-poisonous character, they are widely used in foodstuff factories, both for the sterilisation of plant, and for spraying into the air in order to keep the atmosphere sterile and sweet. They also find innumerable applications in the treatment of plant and equipment used to contain materials which are liable to ferment and become obnoxious on standing.

Sodium hypochlorite solutions have an important advantage over other foodstuff disinfectants in that they leave no after-smell when sterilisation is completed, only a trace of common salt (actually a preservative) being left behind. In milk product factories, where, since milk is a potential germ-carrier, the maintenance of sterile conditions is of the utmost importance, sodium hypochlorite is used to good effect. It is interesting to note in this connection that, with the exception of mechanical milkers and similar appliances, the authorities in this country forbid the use of oxidising agents for the cleaning of vessels used for containing milk, while in some parts of America the use of sodium hypochlorite solutions for sterilising such vessels is compulsory. Sodium hypochlorite is also particularly applicable for the disinfection of foodstuffs which are most frequently eaten raw, such as shellfish, vegetables, and fruit, where the sterilisation effected by the high temperatures of cooking is absent. Watercress may be gathered from a polluted stream, vegetables such as radishes, tomatoes, and lettuces which are eaten uncooked must frequently pass through unclean hands, while fruits, particularly those having their origin in warm climates and foreign countries, must have been subjected to risks in collection, in packing, and in transit. Immersion of these foodstuffs for half an hour in a solution so diluted as to contain ten parts per thousand "available chlorine" will kill all coliform organisms of intestinal origin, and incidentally will also remove caterpillars and slugs from green vegetables. Subsequent washing for a few minutes will remove any chlorinous taste.

Hypochlorites are used not only for the more obvious sources of infection, such as latrines and wash-houses, but also for the sterilisation of canteen equipment. It is well known that cracks in cups and plates frequently harbour disease germs, which are not removed by washing in hot water in the usual way. The addition of a little hypochlorite to the washing water will effectively sterilise all articles and so prevent the spread of disease. Hypochlorite, when used in this way, will also remove vegetable odours associated with dish-washing water.

Future Developments

Health statistics over the past fifty years clearly show the great advances made due to the recognition of the properties of sterilising and disinfecting agents, and it is

(*Continued on page 75.*)

PAYING FOR NEW PLANT—ESTIMATING VITAMIN A—MODERN PACKAGING EXHIBITION—APPETISING BISCUIT PACKS—HOME PRODUCE FOR CANNERS

Inventions and Patents in 1933

We have received the following interesting communication from Mr. George H. Rayner, R.P.A., of Rayner and Company, registered patent agents:

In the past year the figures of H.M. Patent Office show that applications for patents were about 37,000, and it is very satisfactory to know that the manufacture of food has held a prominent position in these figures, with which must be associated the registration of trade marks and designs.

The trade has naturally called for regular information on patents and inventions which have been duly reported in FOOD MANUFACTURE and have been fully appreciated by the readers.

The inventions which have been most appreciated in the past year by manufacturers and traders in this country relate generally to improved machinery and methods of production to reduce the cost and improve the quality of our manufactures.

This is clearly of more importance to us as a manufacturing country than that there should have been any epoch-making inventions which often may go to upset some branches of trade, and it is probably better that we should go forward gradually with important improvements in our present methods than devote our attention exclusively to any new and extraordinary individual invention.

There is no doubt that from time to time most important inventions have been produced, but, generally speaking, those which are really useful both to the inventor and the trade of the country are those which gradually improve the whole system instead of producing violent alterations. These gradual improvements come mostly from the generally observant members of the community who take advantage of recognising certain difficulties of the existing articles and make commonsense improvements upon them to meet the exigencies of modern times. It is open to anyone with powers of observation to turn these faculties into profitable accomplishments.

Paying for New Plant

The proper use of credit to acquire new plant and equipment, to extend and modernise premises and to increase profits, is admirably dealt with in a brochure entitled *New Plant which Pays for Itself*, issued by the United Dominions Trust, Ltd.

The brochure emphasises the importance of keeping plant absolutely up-to-date. Modern plant means more efficient production, lower working costs, and increased profits, yet there are comparatively few factories or works or shops of which it can truthfully be claimed that they have the latest in plant or equipment, or that they cannot be improved.

United Dominions Trust announce in their brochure that they are prepared to provide all the money needed for the re-equipment of sound British businesses.

The credit is granted to the manufacturer (or seller) to enable him to extend credit to the buyer. All the buyer need do is to tell the manufacturer (or the merchant from whom the plant or machines are to be procured) that the purchase is to be made on credit through United Dominions Trust.

Any reader interested in this scheme would do well to obtain a copy of the above-mentioned brochure from the United Dominions Trust without delay.

Estimating Vitamin A

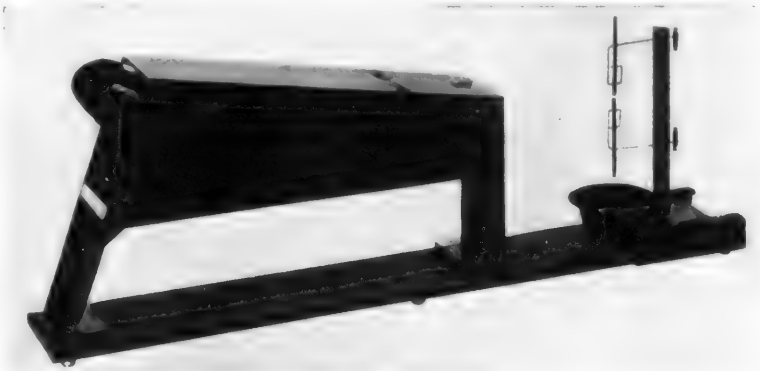
A booklet recently issued by Adam Hilger, Ltd., describes a new means of testing the vitamin A chromogen content of cod and other fish liver oils, a most important matter in the successful medical and dietetic application of these substances.

The apparatus (for which patents have been applied in Great Britain and abroad) is known as the Hilger Vitameter A. It measures the absorption of the solution for radiations in the immediate neighbourhood of 3,280 A and is based on the spectrophotometric method of test. Measurements are made visually by comparing the intensity of two fluorescent areas and rendering them equal by a photometric device whose scale gives readings that are a direct measure of the vitamin A chromogen content.

The makers claim that the method is more convenient and better suited to use by comparatively unskilled operators than those hitherto adopted.

The possibility of the use of this apparatus at all stages of the process of extraction, refining, blending and distribution, even by comparatively unskilled labour, should render it of more than ordinary interest to the food and allied industries.

Copies of the booklet referred to may be had on application to the manufacturers.



The Hilger Vitameter.

Food Companies in 1933

We have received with interest a copy of their Annual Report, relating to the registration of new companies during the past year, from Jordan and Sons, Ltd., company registration agents, of Chancery Lane, London.

This report contains a good deal of statistical information regarding the food and allied industries. 973 new food companies, for example, were registered during 1933 (incidentally, this figure includes 15 public companies), the total capital involved amounting to well over 14 millions sterling.

In this category the bulk of the capital was contributed by Ranks and McDougall's Trust, the former company, indeed, being responsible for the year's record, as witness the following extract from Messrs. Jordan's report:

"The largest capital of the year was the £7,295,600 of Ranks, Limited. This company, which aroused a great deal of public interest, was formed to acquire at least 90 per cent. of the capital of Joseph Rank, Limited."

Another noteworthy registration in the food group is Peacock's Stores, Ltd., a public company with a capital of £300,000.

* * *

Modern Packaging Exhibition

A modern packing exhibition, which will include exhibits by package manufacturers, designers, national advertisers, advertising agencies, and equipment manufacturers, and will feature daily cinema films showing the processes used by prominent companies, and a series of authoritative lectures, is to be staged at Dorland Hall, London, W., from May 30 to June 9.

The promoters claim that every branch of the packaging industry will be represented in the exhibition, which will be divided into two sections:

Section I.—Displays by package manufacturers, designers, art studios, advertising agencies, etc.

Section II.—Packaging machinery and equipment.

It is intended that next year's inaugural exhibition shall be the first of a series, to be held each year, and special attention will be devoted, in the first exhibition, to those packs, display units (display containers with accompanying packages) which have been placed on the market during 1934. There will also be a special exhibition, entry for which is free, of the best packed products submitted by national advertisers, producers, etc.

The following are invited to submit entries:

Manufacturing companies making containers, including cartons, bottles, metal boxes, tubes, canisters, closures, bags and envelopes, jars, boxes, barrels, kegs, etc.

Manufacturers of packaging materials, including foils, wrappings, ribbons, seals, labels, moulded plastics, adhesives, boards, case liners, crepe wadding, pads, lace paper, stoppers (glass), staplers, etc.

Manufacturers of packing machinery and equipment, including can capping, filling, carton making, glueing, labeling, sealing, stapling, tying, cartoning, lining, lifting, weighing, wrapping, embossing, etc., plant.

National advertisers and users of packs and packaging equipment, package designers, advertising agencies, etc.

It is intended to set aside one room at which prominent authorities will give addresses on all phases of package design, manufacture and presentation, while daily cinema exhibitions will describe some of the packaging methods used by prominent national advertisers.

* * *

Appetising Biscuit Packs

Ideas for new biscuit packs are embodied in the two American one-pound cartons illustrated on this page. The name "Nobby Shortbread" has been chosen as typical of the first of these products, in so far as it indicates its general shape and character. The container itself is in four colours—a combination which allows the biscuits to be depicted in their natural colours. The background is maroon, the lettering being thrown into relief by a white panel. In the package intended for Sunshine Butter Macaroons a sweeping design running under the biscuits brings them out with excellent effect. Distinction is again accomplished by the colour scheme. The background this time is in turquoise blue, while the name appears in butter yellow. The manufacturers attribute a great deal of the success of these two products to their hygienic appearance and appeal to the appetite.

* * *

Neco Motors

A new list of Neco motors has been sent us by The Normand Electrical Co., Ltd.

Various types of food machinery are shown, driven by Neco motors—a rotary sweet cooler, for example, made by Brierley, Collier and Hartley, Ltd., a Pfaudler glass-lined pasteuriser, a mincing machine made by Messrs. G. S. Foster, a Russell cake whisk, and a dough divider manufactured by F. W. Mason, Ltd.

The primary purpose of this list (which, incidentally, is very accessible and neatly arranged) is to bring the advantages of Neco motors before machinery makers. Nevertheless, it should also prove of interest to quite a number of food manufacturers.

Copper-Bronze Roofing

An illustrated folder and blue prints from the Enfield Rolling Mills, Ltd., describe in attractive detail the qualities and application of their Tecuta copper-bronze roofing.

This is said to present a new and inexpensive method of employing copper-bronze for the purpose in question, the roofing being fixed by means of an asbestic cement, which possesses remarkable adhesive and elastic properties at varying temperatures. Other points in its favour are briefly and appositely touched upon in the folder, while photographs of it actually *in situ* are also reproduced.

* * *

Home Produce for Canners

Developments in the policy of providing the British canning industry with home-grown produce of every type to help farming and avoid importations are reported from the Agricultural Institute and Experimental Station, Kirton, Lincolnshire.

Large-scale experiments in Lincolnshire are nearly completed in the production of haricot beans, which are now imported in tremendous quantities from the Balkans and Japan.

The experiments were started three years ago. Plots of a number of American varieties of kidney beans, English varieties and haricot beans were grown in the first year, while in 1932 the varieties were grown in blocks by themselves. The experiments were made to obtain information regarding the yield of beans per acre.

We understand that immediately the present crop has been threshed a further report on the subject will be issued.

INFORMATION and ADVICE

Olive Brining—Celery Salt—Tablet Making—Repacking of Dates—Browning of Lemon Curd—Mushroom Ketchup—Free-Flowing Salt—Shipment of Asparagus—De-frosting of Meat—Casing Cleaning—Potato Crisps—Tripe Dressing—Golden Syrup—Dextrose in Fondant—Ice Wafers

Olive Brining

1,515. *Kindly supply some particulars of the methods used for the brining of olives.* (London.)

This subject was dealt with fully in the July, 1933, issue. Briefly, one method is to immerse the unripe olives in strong lye for 24 hours. Then wash thoroughly and pack in brine (the water having been previously boiled) containing 10 oz. salt to the gallon of water.

Celery Salt

1,516. *With regard to the preparation of celery salt, can you please inform us of the proportion of salt that is added to the ground celery seed, and if there is any other ingredient?* (Liverpool.)

You might try using 20 per cent. of dry ground celery seeds. Mix and dry well. Regrind and pack perfectly dry.

Tablet Making

1,517. *Will you kindly furnish me with particulars of tablet making and formulæ?* (Bombay.)

We are afraid that we cannot give you any useful information in the course of a letter, as you do not state just what kind of tablet you have in mind. Your best plan would be to consult a general article we published in the October, 1930, issue of our associated journal, *The Manufacturing Chemist*, by Mr. T. H. Fairbrother, entitled "Tablet Manufacture." We should be glad to supply a copy of this issue if you think it would be of interest to you.

Also we would advise you to get in touch with the makers of tablet making machines, who would, of course, be glad to furnish you with their advice.

Repacking of Dates

1,518. *Please supply your advice on the repacking of dates.* (Yorkshire.)

Much depends on the class of trade. One point to observe is that the dates when unpacked are free from "sugary" deposits, indicating fermentation. If there are any signs of this, the dates should be washed in warm soda water. Another is that care should be taken not to break the skin, which Nature has provided as a barrier against infection. In some cases the dates are dipped in a gum solution to seal them. Sometimes they are wiped with glycerine. After packing, the dates are pressed, to give a flat smooth surface. Often this is wiped over with glycerine.

Browning of Lemon Curd

1,519. *We have come across cases of lemon curd turning brown round the edges of the tarts after baking. Can you tell us the cause of this trouble?* (England.)

Without knowing the quantities of ingredients in the curd it is difficult for us to be of any assistance, especially as this may arise from any of several causes. If flour is used as a thickener, wheat flour should be employed. Other possible causes may be excess of sugar, inferior fat, too slow an oven, pastry cut too thick, or insufficient curd in tarts. The paste should not be cut too thick—not more than $\frac{1}{4}$ in. when baked. The tart should be filled to within $\frac{1}{4}$ in. from the outer edge.

We referred the enquirer to matter previously published in FOOD MANUFACTURE on lemon curd and quoted a couple of new formulæ.

Mushroom Ketchup

1,520. *Can you oblige us with a recipe for a thick grade of mushroom ketchup, as distinct from the very thin grades now on the market?* (London.)

This is simply a matter of making use of a thickening agent such as wheat, corn, or sago flour. The flour is made into a thin paste with some of the liquor and added to the rest about a couple of minutes before boiling is complete.

Free-Flowing Salt

1,521. *Can you inform us what ingredients are used to obtain a free-flowing salt?* (Midlands.)

It is common practice to incorporate a small proportion (best determined by actual trial) of tri-basic calcium phosphate in dry salt. Rice flour, sometimes employed for the same purpose, does not prevent lumping and caking to the same extent as does the phosphate.

Shipment of Asparagus

1,522. *What are the temperatures and humidity most suitable for the transport of asparagus from South Africa to England? I am given to understand that asparagus must not be frozen, and that the temperature must not drop below 36° F., with a humidity of* 80-90. (Rhodesia.)

So far as we know, there is not much information available as to the best conditions for the storage of asparagus. Some preliminary experiments at the Low Temperature Research Station, at Cambridge, have shown that 34° F. is preferable to 40° F. Temperatures below, say, 30° F. become rather risky on account of the possibility of freezing.

The humidity must certainly not be too low, otherwise shrinkage would occur.

We are looking further into this matter and shall be glad to hear from anyone who can supply more information on the subject.

De-frosting of Meat

1,523. *Will you kindly supply information as to the best method of de-frosting meat?* (Glasgow.)

There does not yet appear to be a method which can be called satisfactory. Much work remains to be done. On the theoretical side you should apply to the Low Temperature Research Station or consult the Annual Reports. On the practical side some interesting experiments are being carried out at the Smithfield Institute, involving the adjustment of the humidity of the de-frosting chamber, which is clearly one of the main factors to be taken into account. A satisfactory method which can be simply and cheaply carried out with the minimum loss from drip has still to be discovered. Present methods are either too elaborate, such as the electrolytic method, or too crude and wasteful, such as hanging the meat between a couple of steam boilers.

This subject will be taken up for more detailed discussion in a future issue.

Casing Cleaning

1,524. *We should be glad to have some information on the cleaning of hog casings.* (Glasgow.)

An interesting account of modern developments in U.S.A. is taken from Goedert and Maddux's *Pork Packing*, and runs as follows:

Better working conditions in and around the casing cleaning department are claimed to be possible as the result of a modern method of cleaning casings. In this process the need for fermenting and the resulting odours are done away with.

In addition to this advantage the process, it is said, gives the casing a very good colour and better strength. There is also secured a 10 per cent. better yield, a casing free from odour and with improved keeping quality. Some saving in the amount of floor space required is also claimed.

After the casings are removed from the animal they are immediately stripped through a set of power-operated burlap-covered wringer rolls approximately 8 in. in diameter and 30 in. long. After passing through these rolls the casings are placed in a vat of water with a temperature of 110° to 115° F., where they are held 90 minutes.

The casings are then stripped through a second set of rollers similar to the first set, but a tighter adjustment, and are placed in a second vat of warm water, the temperature of which is also 110° to 115° F. They are held in this second vat for about 30 minutes, after which they are stripped by hand into a third vat with a water temperature the same as that in the preceding vat.

Immediately following the third stripping the casings are given their first machine cleaning. This is roughly done, and removes only the slices and heavy slime. Following the first machine cleaning, the cases are held in cold water until the operators are ready for the second machine cleaning, which, if desired, can be done immediately. After this second cleaning they are ready for grading.

Another method which, it is claimed, gives maximum yields at minimum cost, is to strip the casings immediately after pulling, soak in a weak brine for 24 hours, then strip into a tub of warm water (110° F.), which is placed directly in front of the casing cleaning machine. This machine, it is claimed, will handle 300 strings per hour and will do practically perfect cleaning on one running.

Potato Crisps

1,525. *I have been recommended by the Ministry of Agriculture to approach you for information regarding the preparation of potato crisps.* (Yorkshire.)

By far the most satisfactory way is for you to requisition the services of an engineer with experience in design of layouts for food factories. The design of the layout and the types of plant used will very largely depend on the output proposed. However, the following general account of an American process may prove interesting:

The potatoes are peeled, in bag lots, in a revolving unit which has an abrasive lining instead of baffles. They are sliced by means of a specially designed disc which is fitted, radially, with a series of knives, and revolves through a vertical plane so that wafer-thin slices are cut as the potatoes are held against it by means of a movable lever in the trough-like feeding channel.

When the newly cut slices have been thoroughly washed in running water to remove surface starch and fibre particles, they are placed in cotton mesh bags and spun as dry as possible in a standard laundry centrifuge. Open-mesh metal baskets containing 30 lb. batches of the dried chips are then lowered into vats of high-grade vegetable oil heated to 350° to 375° F. and cooked for about 3 minutes. Each vat, $6 \times 2 \times 2\frac{1}{2}$ ft. and containing 125 gal. of oil, is made from heavy sheet metal and is set in a brick furnace heated by an oil burner. At one end of the cooking vat is a metal drain pan on which can be set two baskets of cooked chips so that the excess oil may drain, while hot, from the chips and into the vat. By this method of cooking and handling, each 100 lb. of sliced potatoes produces 30 lb. of finished chips containing 10 lb. of oil.

The cooking oil is freed from particles of potatoes, which may char and lower the quality of the oil, by being run through a centrifuge clarifier once a day. Direct pipe connection permits the oil to drain from the cooking vat to the clarifier on the floor below and to be pumped back into the vat after clarification.

Tripe Dressing

1,526. *We should be glad to have some particulars of the methods used in the dressing of tripe.* (London.)

Briefly, the method is as follows. We give only a brief account, as this subject is to be dealt with at length in one of Mr. Gerrard's articles which are running as a series on the Manufacture of Small Goods (including sausage) in the *Food Industries Weekly*.

The empty stomach is stirred in warm water, to which a little soda has been added, until all dirt is removed. Then hang on a hook and scrape with a blunt knife until it is quite clean. Now boil in water containing a little alum (for bleaching purposes) until tender. Wash in water until cold. Take it out and remove the outer membrane and also trim it. Store it in a 10 per cent. cold solution of bisulphite of lime.

Another method, after the preliminary washing (which should always be done immediately on removal of the stomach from the animal), is to soak it for an hour in tepid water to which has been added some lime. Scrape in the same water and wash well in fresh water.

Golden Syrup

1,527. *We respectfully refer to page 36 of the* FOOD MANUFACTURE *for January, 1934, and the paragraph headed "Golden Syrup."*

We see from same that you were able to supply all information in connection with the make-up of golden syrup, and shall be obliged if you will pass on to us similar information; that is to say, we require weights and proportions of the various materials, also temperatures and what gravity the material is brought to, and if possible the quantity of previously boiled water which requires to be added to bring it to the required temperature. (Scotland.)

Such information as is in our possession on these points was supplied to the enquirer.

Dextrose in Fondant

1,528. *Kindly inform us whether it is possible to use solid glucose (dextrose) in place of cane sugar for the preparation of fondant for icing small cakes, fancies, gateaux, and petit fours. All information concerning preparation would be welcome, also names of suppliers.* (Bristol.)

As is well known, dextrose develops a much smaller crystal than does sucrose, but, apart from this, it has the power of reducing the size of sucrose crystals. For this reason, it is claimed that dextrose offers certain definite advantages in the manufacture of all classes of fondants.

The use of dextrose in fondant making calls for a certain amount of practice or technique in order to obtain the best results, and the necessary points to be borne in mind are—(1) the dextrose is less soluble than sugar and, therefore, the fondant must have a slightly higher moisture content, and (2) that dextrose is somewhat slow in developing crystal formation and also has the power, to a degree, of retarding the development of sucrose crystals unless special precautions are taken. It is for this reason that we emphasise the predevelopment of sucrose crystals in some of the methods of usage recommended below.

It is possible to replace entirely sucrose by dextrose, but the general practice is to replace a certain portion of the sucrose by dextrose, thus making a blended dextrose-sucrose fondant.

Lehmann Cream Machine Method.—Under this method the usual sugar-glucose mixture is boiled to 238° F. for the casting fondant, or 232° F. for bakers' fondant or cream fillings. The syrup is run into the flat Lehmann rotating pan and allowed to cool to about 122°. The pan is then rotated until the syrup becomes milky, due to the development of small sugar crystals. At this point an amount of dextrose equivalent to 10 per cent. by weight of the sugar used is added in its dry form to the bulk, the pan being still kept in rotation until complete development of crystals takes place. This constitutes the fondant base.

In the Fondant Machine Method the usual sugar-glucose fondant base is prepared and mixed to the consistency desired with a syrup made up one-half dextrose and one-half liquid glucose to a strength of 30° Bé. In the case of casting fondants, this diluting syrup is, of course, used in the melting kettles, the maximum temperature during this operation being 133° F., and if an additional amount of dextrose is desired, a further amount equivalent to 10 per cent. of the bulk can be added in its dry form direct to the melting kettle.

The All-Dextrose Fondant.—Should it be desired to replace the whole of the sugar by dextrose, the fondant can be produced by boiling 100 parts of dextrose with water to 230° F. This mass is then thoroughly cooled and beaten in a beating machine. When the temperature has fallen to between 130° to 140° F., 1 part of dry powdered dextrose is added, and this forms the "seed" for the crystal. The beating is continued until the dextrose crystals are fully developed and the mass has the identical appearance of an ordinary fondant base. At this point a previously prepared syrup is added, this syrup being made up by taking 10 parts of liquid glucose and 15 parts of invert sugar with a little water, boiling to 230° F., and finally cooling down to 150° F. The beating is continued until a homogeneous mass is obtained, which forms the stock dextrose fondant.

For dilution purposes a 30° Bé. liquid glucose syrup is used, but it is essential that the temperature of the mixture between the dextrose stock fondant and the syrup should not exceed 90° F. The addition of small quantities of gelatin to the diluting syrup will usually be found advantageous.

Owing to its lack of sweetness, this particular type of fondant is not usually used alone, but rather for blending

with sugar-glucose fondants in any proportion desired. However, for low-temperature filling purposes the all-dextrose fondant offers a considerable advantage owing to the low casting temperature and the power that dextrose possesses of enhancing the more delicate flavours that are desirable in cream fillings.

Ice Wafers

1,529. *Where can we obtain information on the manufacture of ice wafers, filling for ice wafers, and ice-cream powders?* (London.)

There is a chapter devoted to wafer manufacture, including ice wafers, in Fritsch and Grospierre's book on *The Manufacture of Biscuits*, published in 1930. The subject is too extensive to be dealt with here. Briefly, a wafer batter is made in the usual type of cake beater or whisk, taking care that the beater is completely submerged in the batter. The prepared batter is baked in wafer tongs or an automatic wafer machine, the particular type used being determined by the output required. Particulars of the equipment available are best obtained from the manufacturers. There are also special machines for spreading a thin uniform layer of cream over the wafer sheet; these are known as "wafer spreading machines." Other equipment includes some form of wafer saw and a scrap grinding machine for grinding up saw scrap and broken wafers for use with paste or praline fillings.

Ice wafers include cups, cones or folded wafers, and cigarettes or rolled wafers. Cups are simply stripped off by hand after baking. Cones are folded by hand, at the delivery end of the tongs. The wafer is then still quite soft and may be folded in four and placed in a sort of press which gives it an even contour. Cigarettes are also rolled by hand; the circular sheet issuing from the tongs is rolled round a 4 to 6 gauge wire rod, the tube thus formed being then cut to the required length. There are special wafer tongs for making cheese straws. As stated above, the manufacturers of this special type of equipment should be consulted.

There is not much point in giving recipes for wafers and fillings in absence of particulars as to your special circumstances and requirements. Your best plan is to consult the work mentioned above in which a selection of such formulæ is given.

For ordinary sheets, Fritsch and Grospierre give the following:

Flour	75 lb.
Water	13 to 14 gal.
Milk powder	2½ lb.
Malt extract	4 oz.
Melted coconut butter	1¾ lb.
Soda	4 oz.
Ammonia	2 ,,
Yellow colour	4 ,,
Red colour	2 ,,

Cream up flour, milk, malt extract, and butter together for about 5 minutes. Then add water in 3 or 4 separate lots, so as to give a complete beating period of about 15 minutes. Add the soda during the last minute, together with ammonia and colours. Then strain. Soda and ammonia should be added only if the sheet is firm enough to allow their use.

There are many formulæ for wafer fillings. As an example, one may quote "Supreme Filling, as made by Pernot":

Crystal sugar	40 lb.
Toasted blanched almonds	24 ,,
Cacao butter	12 ,,
Powdered vanilla	2 ,,
Praline wafer scrap	20 ,,

Grind up fine and let down with the melted butter over steam bath, in event of the filling being too stiff. Keep at temperature of about 75° F. before spreading the sheets. After spreading, allow the cream to harden in a cool place; then dry and saw immediately.

A vanilla filling for sugar wafers may consist of:

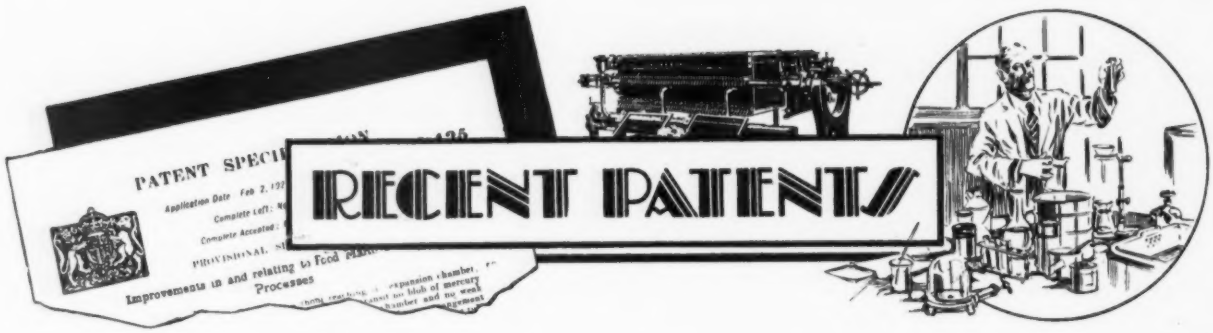
Whites	5 quarts
Fine sugar	30 lb.
Vanilla powder	1½ lb.
Vanillin sugar	1½ lb.

Beat whites stiff, adding 5 lb. of the sugar to get a light meringue. Follow with rest of sugar, in which vanilla powder and vanillin sugar should have been already mixed. Spread the sheets and dry carefully at 175° F. As soon as the sugar cracks under pressure of the finger, withdraw from the drying chamber and saw and pack.

As regards ice-cream powders, we gave some information on page 338 of the November, 1931, issue. As previously indicated, we intend to give more at some time in the future when the special investigations now in hand have been completed.

DISINFECTANTS AND FOODSTUFFS (continued from page 69).

interesting to note that the consequent saving of human life has not called for elaborate and expensive equipment. Chlorine and the hypochlorites are ordinary chemical substances of relatively simple nature, and their application is outstanding in its simplicity. In spite of this much remains to be done, especially in connection with the actual *sources* of foodstuffs—such as dairies, farms, mills, and waterworks. While reputable food concerns usually lead the way in hygiene and sanitation, there still remains another class of concern in which improvements could be effected. Another aspect to be borne in mind is the distribution of foodstuffs. Public opinion is increasing against the practice of many retail shops in exposing food to grave risks of contamination, and this is reflected in the growing tendency to distribute only wrapped foods. The logical outcome to perfect hygiene in food factories is an equivalent standard of hygiene amongst food distributors.



These particulars of New Patents of interest to readers have been selected from the "Official Journal of Patents," and are published by permission of the Controller of H.M. Stationery Office, and the "Official Journal of Patents" can be obtained from the Patent Office, 25, Southampton Buildings, London. W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

34225. GIBBON, S. H.: Treatment of rice, paddy, etc.
33530. JONES, T. M.: Apparatus for cooling milk, etc.
34369, 34370. KRONBERG, N. M.: Manufacture of milk powder. (Sweden, July 29.)
34157. MARGUERAT, R.: Machines for filling and stopping containers for food.
33941. NAYLOR, W. H.: Machines for packing flour, etc.
33650. POLLAK, J. E. (Protan Chemische Fabrik Ges.): Production of envelopes or skins for articles of food.
34227. TEATINI, D.: Purification of sugar refinery, etc., juices.
34271. WENNERGRUND, O. D.: Appliances for introducing fat, lard, etc., into meat. (Sweden, December 17, 1932.)
35001. CHEMISCHE FABRIK KALK GES.: Preservation of green foodstuffs.
34427. FOOD MACHINERY (M. AND P.), LTD.: Cookers and coolers for canned goods.
34519. GREENSMITH, H. W.: Egg preservative.
35055. HOLDER, W. E.: Mechanical fruit-juice extractor.
34940. HOSIER, H., and PATERSON, J. K. K.: Preserving perishable commodities.
35039. SOC. R. MAUBAILLARCQ ET CIE: Preservation of fish by cold storage. (Germany, December 16, 1932.)
35820. BARNETT, S. H. G., and ROBINSON, H. G.: Paper containers for milk, etc.
35367. BÖGGILD AND JACOBSEN: Machines for manufacture of filled chocolates.
35368. BÖGGILD AND JACOBSEN: Moulds for chocolate-casting machines. (Germany, July 18.)
35577. GALVEZ GARCIA, A. M.: Manufacture of banana flour.
35766. GIBBON, S. H.: Treatment of starch-containing cereal grains.
35356. LEHMANN, H.: Manufacture of crisp bread.
35344. SMITH, L. W.: Devices for sterilising and drying fish, etc.
35942. BOSTOCK, H.: Preserving foodstuffs, pelts, etc.
35957. BURNARD, H., and COTTER, E. W.: Pasteurisation of milk, etc.
36577. NEILSON, R. J.: Freezer cans.
36385. SCHMALFUSS, H., and WERNER, H.: Edible flesh extracts. (Germany, July 8.)
36468. SLEEMAN, O.: Manufacture of malt.

Complete Specifications Accepted

402,615. SPEIDEL, R.: Process and apparatus for keeping provisions and other perishable goods fresh by cooling.
402,839. ELLIOTT, E. S.: Refrigerated containers for the preservation and transportation of ice-cream, liquids, and other substances.
402,948. ADLER, DR. M.: Process of manufacturing soy milk and its derivatives.
402,953. AUSTERWEIL, DR. G., and JEANPROST, C.: Purification and/or sterilisation of liquids by means of base exchangers.
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Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

MILK IN BREAD

(*Continued from page 67.*)

Suggested Improvements Debatable

It is also stated that milk bread "keeps better" than water bread. This is a matter for the baking experts to decide amongst themselves, but I find it difficult to understand which argument the statement is meant to strengthen. Is it designed to encourage the baker's support of this proposal by telling him that the milk bread that he will be asked to make will keep longer than water bread, so that there will be less waste, and, presumably, less bread sold? Or is it meant as an inducement to the ordinary householder, in return for the extra ¼d. per 2-lb. loaf that he will have to pay, unless the baker kindly decides to pay it for him? It seems to me to be extremely questionable whether there is a 7 per cent. wastage of bread through staleness in those households where an improvement in dietary level is most needed. If there is not this wastage, it is difficult to understand how the improved keeping qualities of the loaf will save those households enough to compensate them for the extra cost of the milk bread.

Once more the advocates of lactification are confronted with a dilemma. If lactification is optional, those who need its alleged benefits will not get them; if it is compulsory, the price of bread must rise, to the detriment of the very people it is designed to help.